Shropshire Council

Bridgnorth Draft Air Quality Action Plan

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management

July 2024

Document Control Sheet

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Executive Summary

This Air Quality Action Plan (AQAP) has been produced as part of our statutory duties required by the Local Air Quality Management framework. It outlines the action we will take to improve air quality in Shropshire Council between 2024 and 2029.

This action plan replaces the previous action plan which was developed from detailed modelling in 2000 and the action plan was amended in 2008. Projects delivered through the past action plan include:

- The traffic management design to ease congestion along Whitburn Street and High Street that resulted in congestion into the AQMA. This included adding a mini-roundabout rather than a turn into Whitburn Street. Vehicles were also encouraged to access the High Street via a new road developed through Old Smithfield.
- Change to one-way traffic flow for Whitburn Street, east of the AQMA. This was designed to restrict westbound traffic from High Street into the AQMA.
- Pricing changings to parking within Bridgnorth to help prevent traffic re-circulating through the AQMA in the search of free parking.

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010

[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3]. Shropshire Council is committed to reducing the exposure of people in Shropshire to poor air quality in order to improve health.

We have developed actions that can be considered under four broad topics:

- Alternatives to private vehicle use
- Promoting travel alternatives
- Public information
- Traffic management

Our priorities are:

- Improving air quality in Bridgnorth by improving the flow of traffic through the junction of Pound Street, Salop Street and Whitburn Street;
- Managing traffic flows through the Bridgnorth AQMA through Variable Messaging Signs to dissuade road users.
- Working with the local schools to develop School Travel Plans to divert traffic away from the AQMA and raise awareness.

In this AQAP we outline how we plan to effectively tackle air quality issues within our control. However, we recognise that there are a large number of air quality policy areas that are outside of our influence (such as vehicle emissions standards agreed in Europe), but for which we may have useful evidence, and so we will continue to work with regional and central government on policies and issues beyond Shropshire Council's direct influence.

Responsibilities and Commitment

This AQAP was prepared by Bureau Veritas on behalf of Shropshire Council with the support and agreement of the following officers and departments:

[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013

Kieron Smith – Environmental Protection Service Manager

Joanne Chanter – Environmental Protection Team

Les Pursglove - Assistant Director of Health, Environmental Protection & Healthy Place

Matt Johnson - Executive Manager - Strategic Projects - Highways and Transportation

Ffion Horton - Service Development Programme Manager Highway Policy and Strategic Infrastructure

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Rhiannon Letman-Wade – Sustainable Travel Manager

This AQAP will be approved by:

Rachel Robinson - Executive Director of Health, Wellbeing and Prevention. Director of Public Health.

Tracy Darke - Assistant Director Economy and Place

Andy Wilde - Assistant Director - Infrastructure • Assistant Director Highways and Transport

This AQAP will be signed off by Rachel Robinson, Director of Public Health.

This AQAP will be subject to an annual review, appraisal of progress and reporting to the Cabinet member for Planning and Regulatory Services. Progress each year will be reported in the Annual Status Reports (ASRs) produced by Shropshire Council, as part of our statutory Local Air Quality Management duties.

If you have any comments on this AQAP please send them to Joanne Chanter, Environmental Protection at:

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1 Introduction

This document represents an initial draft action plan for review and comments by DEFRA. Shropshire Council intend to consult on a further-draft action plan as soon as feedback is received (taking into account DEFRA's comments) to the wider public and relevant stakeholders.

This report outlines the actions that Shropshire Council will deliver between 2024 and 2029 in order to reduce concentrations of air pollutants and exposure to air pollution; thereby positively impacting on the health and quality of life of residents and visitors to Bridgnorth and the wider Shropshire area.

It has been developed in recognition of the legal requirement on the local authority to work towards Air Quality Strategy (AQS) objectives under Part IV of the Environment Act 1995 and relevant regulations made under that part and to meet the requirements of the Local Air Quality Management (LAQM) statutory process.

This Plan will be reviewed every five years at the latest and progress on measures set out within this Plan will be reported on annually within Shropshire Council's air quality ASR.

2 Summary of Current Air Quality in Bridgnorth

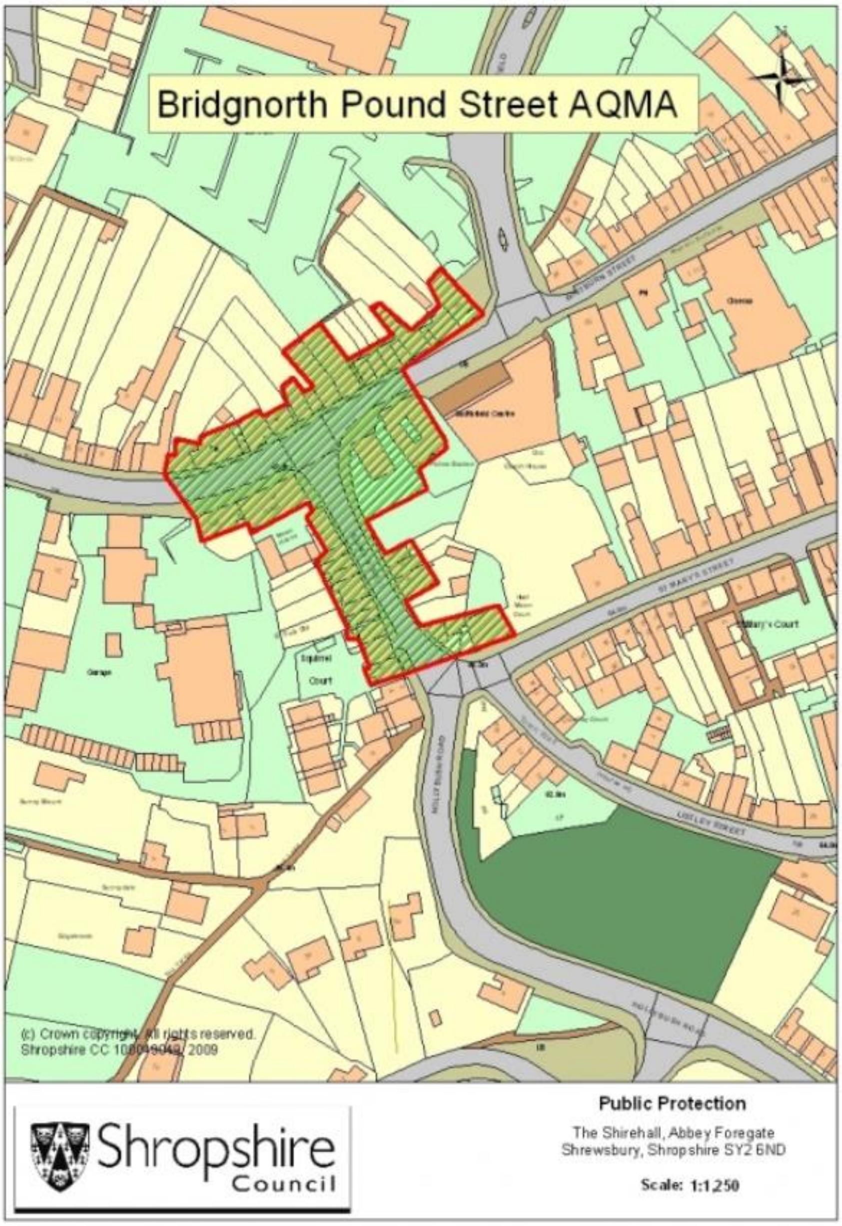
The latest Annual Status Report (ASR) for Shropshire Council is the 2024 ASR[4] which was submitted to Defra in 2024.

2.1 Summary of AQMA

The Bridgnorth Air Quality Management Area (AQMA) an area encompassing Pound Street and the junction of Whitburn Street and Salop Street. The AQMA was designated in 2005 for the exceedance of the annual mean NO_2 air quality objective due to congestion associated with the unitary authority road. The highest monitored concentration of NO_2 within the AQMA was 54.1µg/m^3 in 2010. The AQMA encompasses 37 residential dwellings including Squirrel Court, which is comprised of retirement apartments, commercial premises and a hotel, this is approximately 150 residents. A map of the extent of the AQMA is shown in Figure 2-1.

[4] Shropshire Council (2024) 2024 Annual Status Report

Figure 2-1 – Bridgnorth AQMA



2.1 Air Quality in Bridgnorth

Table 2-1 – Diffusion Tube Monitoring Data 2018 – 2022 in Bridgnorth

Site ID	Location	OS Grid Ref X	OS Grid Ref Y	Annual Mean NO_2 Concentration (µg/m^3)				
				2018	2019	2020	2021	2022
DF13*	Pound Street	371345	293081	**40.5**	35.6	30.3	33.1	30.1
DF27	Smithfield	371397	293179	26.0	25.8	19.7	23.6	15.8
DF28* 602	50 Whitburn Street	371297	293108	**48.2**	**43.4**	Relocated	Relocated	35.8
DF29*	Adj Rutters	371397	293179	28.9	28.5	21.6	23.9	23.3
DF71*	6 Pound Street, (On Pelican Crossing)	371346	293086	**50.9**	**49.1**	**40.8**	**43.2**	**41.5** (39.8)

Site ID	Location	OS Grid Ref X	OS Grid Ref Y	Annual Mean NO_2 Concentration (µg/m³)				
				2018	2019	2020	2021	2022
DF72*	Mini Roundabout Listley Street (lamp column)	371375	293066	30.0	28.2	22.4	23.8	22.6
DF73*	18 Pound Street (Downspout)	371354	293089	34.1	34.2	26.5	28.7	27.3
DF74*	Lamp Column 9 (Steps of new build)	371340	293125	30.9	29.4	22.7	25.2	24.4
DF75*	Lamp Column 48 (New Build)	371345	293106	30.9	27.6	22.4	24.1	23.9
DF76*	Higgs/Stanton Ralph (Opp 45 Whitburn Street)	371366	293146	33.8	31.8	28.4	28.8	29.5
DF77*	39/40 Whitburn Street Lamp Column	371375	293161	**40.3**	*38.7*	30.4	29.9	29.2
DF78*	Pedestrian Crossing outside 42 Whitburn Street	371360	293152	*39.9*	*38.5*	32.2	35.9	32.9
DF79*	Chill Salon Downspout between green and black door	371346	293143	**48.8**	**42.3**	35.3	*36.9*	35.6
DF80*	48 Whitburn Street Downspout	371334	293139	**50.3**	**43.6**	*37.2*	**40.3**	*37.5*
DF81	Stretton House 3 Salop Street Downspout	371288	293119	28.8	26.7	20.1	23.3	21.3
DF82	Pedestrian Crossing outside 8 Salop Street	371264	293120	27.4	22.7	17.0	20.4	19.1
DF83*	Downspout Of 2 Pound Street Bridgnorth	371341	293096	-	-	-	**49.4**	**47.8**
*located within Bridgnorth AQMA (x) – After Distance Correction								

Table 2-1 details the monitoring locations within Bridgnorth and those within the Bridgnorth AQMA.

Shropshire Council report on air quality within the administrative area through the ASR through the LAQM process. The latest ASR from 2023 reports on air quality in Shropshire in 2022.

Shropshire Council do not undertake any automatic monitoring within the local authority area however, passive monitoring through a network of diffusion tubes was undertaken in 2022 at 57 sites; 15 of the sites are within the Bridgnorth AQMA.

In 2022 there were two exceedances of the annual mean air quality objective of NO_2 within the Bridgnorth AQMA above 40µg/m³. Monitoring location DF83 located on Pound Street within the AQMA recorded the highest concentration in Bridgnorth in 2022. This monitoring site is located at relevant exposure on the façade of 2 Pound

Street. The monitoring location has been in place in 2021 and 2022 and continues to exceed 40µg/m^3 with concentrations recorded of 47.8µg/m^3 in 2022, although reduced from 49.4µg/m^3 in 2021. It should be noted that within the technical modelling of the AQMA within Appendix C that the baseline 2022 modelled result for this monitoring sites was 47.9µg/m^3. This demonstrates the robustness of the model.

A further monitoring location on Pound Street, DF71 also demonstrates elevated concentrations however concentrations for the past five years show an overall decreasing trend from 50.9µg/m^3 in 2017 to 41.5µg/m^3 in 2022. Following calculations using the distance correction tool as the site is located 1.4m away from relevant exposure, the annual mean NO_2 concentrations is 39.8µg/m^3 so only just below the annual mean Air Quality Objective for NO_2.

Overall, the technical modelling of the AQMA, detailed in Appendix C, details that the highest concentrations of NO_2 within the AQMA are along Pound Street, this is likely due to the incline in the road when vehicles are travelling from the south of Bridgnorth from Low Town to High Town, as well as the zebra crossing which is located in the middle of Pound Street. The location of the crossing has added another start-stop section of the road as well as the junction only 20m further north.

It should be noted that due to the nature of the building heights, narrow streets and junctions, the AQMA is a result of the incline in the road as well as street canyoning; an effect where the buildings cause a canyon or tunnel like effect, resulting in restricted air flow and an increase in pollutant concentrations.

Pollutant concentrations in 2020 and 2021 were affected by COVID-19 lockdown restrictions and therefore are not considered suitable grounds for the revocation of the AQMA, however elevated concentrations were still recorded and concentrations within the AQMA are still above the annual mean NO_2 air quality objective in 2022 in two locations. The overall trend of NO_2 concentrations within the Bridgnorth AQMA is a decreasing trend which is encouraging however there is still scope to improve air quality further. The annual mean NO_2 concentration at the remaining 13 diffusion tubes within the AQMA was below 36.0µg/m^3 in 2022. In 2018, only eight of the monitoring locations were below 36.0µg/m^3 showing the decreasing trend in concentrations within the AQMA.

With the decreasing trend in NO_2 concentrations within the AQMA, using the Roadside NO_2 projection factors[5] it is expected that in 2028, the highest monitoring location DF83, which currently monitors at 47.8µgµ/m^3 will be below 10% of the AQO. This is through a natural decreasing trend in NO_2 concentrations and not as a result of the measures to improve air quality in Bridgnorth which are detailed within this AQAP.

Figure 2-2 - Monitoring Locations with Bridgnorth AQMA

5 https://laqm.defra.gov.uk/air-quality/air-quality-assessment/roadside-no2-projection-factors/

3 Shropshire Council's Air Quality Priorities

3.1 Public Health Context

The Air Quality Indicator in the Public Health Outcomes Framework (England) (PHOF) provides further impetus to join up action between the various local authority departments which can impact on the delivery of air quality improvements. The "Air Quality – A Briefing for Directions of Public Health[6]" document published in March 2017 provides a one-stop guide to the latest evidence on air pollution, guiding local authorities to use existing tools to appraise the scale of the air pollution issue in its area. It also advises local authorities how to appropriately prioritise air quality alongside other public health priorities to ensure it is on the local agenda.

The latest Public Health Outcomes Framework Indicator number D01 - Fraction of mortality attributable to particulate air pollution (New Method) for Shropshire was noted to be 4.4% in 2022, down from 5.8% in 2019 but slightly increased from 4.3% in 2020/2021. This is the mortality lowest percentage in the West Midlands Area and below the average for England at 5.5% attributable to air pollution.

To further understand the number of the population of Bridgnorth exposed to poor air quality, a review of the Indices of Multiple Deprivation (IMD) are also included. This has been completed using the Office for National Statistics 'Lower Super Output Area' (LSOA) information.

The number for the IMD are based on deciles of multiple factors of deprivation. The larger the score, the more deprived the area. Bridgnorth has a IMD of 7 out of possible 10 with the 10th indices being the least deprived areas of England. Bridgnorth is in the 7th indices for deprivation in England and therefore lower than the median for England.

[6] https://laqm.defra.gov.uk/assets/63091defraairqualityguide9web.pdf

The AQMA is restricted to 37 properties within Bridgnorth and therefore the population of Bridgnorth living within the AQMA is expected to be less than 150.

3.2 Planning and Policy Context

3.2.1 Shropshire Local Plan

The Shropshire Local Plan was adopted on 24 February 2011 and informs strategic development until 2026. There are no air quality specific policies, however there are policies focusing on promoting sustainable transport methods where developments are expected to generate significant traffic levels.

The draft Shropshire Local Plan was submitted to the Secretary of State for examination on 3 September 2021. The plan once examined this will be adopted and sets out the strategies and policies 2016 to 2038. The draft Local Plan includes the following policies specific to air quality and the AQAP. Policy SP6 states

> *" 8. Protect against exposure to pollution in line with policy DP18 by:*
>
> *a. Minimising exposure to airborne pollutants in the location and design of new development and securing the implementation of the Council's Air Quality Action Plans, having regard to national and international obligations; and*
>
> *b. Safeguarding against the environmental impacts of new development in terms of community/public safety, noise, vibrations and odour and the legacy of contaminated land."*

Policy DP18 Pollution and Public Amenity sets out the council's focus on prioritising the environment and amenity for residents. Specifically, the policy states:

> *"Opportunities to improve air quality through the provision of green infrastructure in accordance with Policy DP14, industry relevant best available techniques, traffic and travel management (including linking to active travel networks) and the provision of electric charging facilities for vehicles should be maximised. Proposals which would lead to an unacceptable risk from air pollution or prevent sustained compliance with limit values or national objectives for air pollutants will be refused unless they can be practicably amended to avoid that risk."*

Additionally, policy DP28 Communications and Transport encourages the use of sustainable transport modes which will benefit air quality.

> *"Responding positively to changes in our climate will require access to better communications infrastructure and more sustainable travel options and services offering choices about the need to travel and the best transport modes. This will help to manage the environmental impacts of travel on climate change, air quality, network noise and public health contributing to the sustainability of communities and protecting our environment."*

3.2.2 Shropshire Local Transport Plan Strategy (2011 -2026)

The currently LTP3 Local Transport Plan Strategy details the transport objectives, policies and programmes for Shropshire. Some of the proposed plans and objectives within this strategy align with those improvements in traffic management within the Bridgnorth AQMA and as such improvements in Air Quality. LTP3 looks to focus on areas such as encouraging more sustainable modes of transport, adoption or new park and rides, considering site specific measures within Shropshire's AQMAs. Shropshire council are currently in development of the LTP4 which is planned to run into 2038.

3.2.3 Shropshire Council Corporate Climate Change Strategy and Action Plan

The Shropshire Corporate Climate Change Strategy and Action Plan was adopted in December 2020. This strategy aims to reduce the carbon footprint of Shropshire Council. Measures includes in the action plan include the installation of EV charging, replacing council fleet vehicles with ultra low emission vehicles and increasing the reliance on renewable energy sources.

3.2.4 Shropshire Local Cycling and Walking Infrastructure Plan (LCWIP)

The LCWIP aims to increase cycling and walking in Shropshire by improving safety and accessibility to these transport methods. In Bridgnorth 20% cycle or walk to work according to the 2011 census. Barriers to cycling or walking in Bridgnorth include the A458 and A442 roads and the lack of cycling infrastructure within Bridgnorth. Improving cycle infrastructure will make cycling safer within Bridgnorth and encourage more people to cycle.

3.2.5 Clean Air Strategy 2019

The Clean Air Strategy sets out the case for action at a national level, identifying a number of sources of air pollution within the UK including road transportation (relevant in terms of the AQMAs currently present within Shropshire). It also sets out the actions required to reduce the impact upon air quality from these sources. It has been developed in conjunction with three other UK Government Strategies; the Industrial Strategy, the Clean Growth Strategy, and the 25 Year Environment Plan.

Key actions that are detailed within the strategy aimed at reducing emissions from transportation sources include the following:

- The publication of the Road to Zero strategy, which sets out plans to end the sale of new conventional petrol and diesel cars and vans by 2040
- New legislation to compel vehicle manufacturers to recall vehicles and non-road mobile machinery for any failures in emission control systems, and to take effective action against tampering with vehicle emissions control systems
- Develop new standards for tyres and brakes to reduce toxic non-exhaust particulate emissions from vehicles. [NB: This action would not necessarily target reductions in NO_2 for which the AQMAs have been declared].
- The encouragement of the cleanest modes of transport for freight and passengers
- Permitting approaches for the reduction of emissions from non-road mobile machinery, especially in urban areas

3.2.6 Air Quality Strategy 2023

In April 2023, the draft of the Air Quality Strategy, which supersedes the Air Quality Strategy (2008) was published. The strategy plans to set out a framework to enable local authorities to deliver for their communities and contribute to the governments long term air quality goals, this includes the new targets for $PM_{2.5}$.

The Air Quality Strategy is designed for local authorities in England to focus on actions to reduce three main pollutants, $PM_{2.5}$, NOx and NH_3. The Air Quality

Strategy is also designed to support and provide relevant information to those local authorities that are preparing AQAPs.

The Air Quality Strategy develops and encourages local authorities to collaborate on the development of measures to improve Air Quality. This includes involving Directors of Public Health at all stages throughout the discussions of Air Quality Action as Air Quality is a public health concern. The Air Quality Strategy also pushes for measures to detail the costs and benefits to help determine the feasibility of a measure.

More emphasis on the dates that measures within an Air Quality Action Plan are also detailed to ensure that measures are carrier out and will help to achieve compliance in a reasonable timeframe.

To promote effective local action, a wider range of bodies are ideally brought into the process of the Air Quality Action Plan, this includes any neighbouring local authorities, The Environment Agency and National Highways. These are denoted as Air Quality Partners. Where a source in control of an Air Quality Partner is contributing toward exceedances of the AQO resulting in and AQMA to be declared, the relevant body can be declared and Air Quality Partner. Air Quality Partners must propose measures they will take to contribute to the AQAP and the dates they will be carried out.

3.3 Source Apportionment

The AQAP measures presented in this report are intended to be targeted towards the predominant sources of emissions within the Bridgnorth AQMA. A source apportionment exercise was carried out by Shropshire Council using a baseline year of 2022, which is considered the new baseline following the vehicular restrictions associated with COVID-19. The pollutant of concern within the Bridgnorth AQMA has been identified as nitrogen dioxide (NO_2) predominantly from road traffic.

A source apportionment exercise was carried out by Bureau Veritas in 2023. The following vehicle classes were modelled:

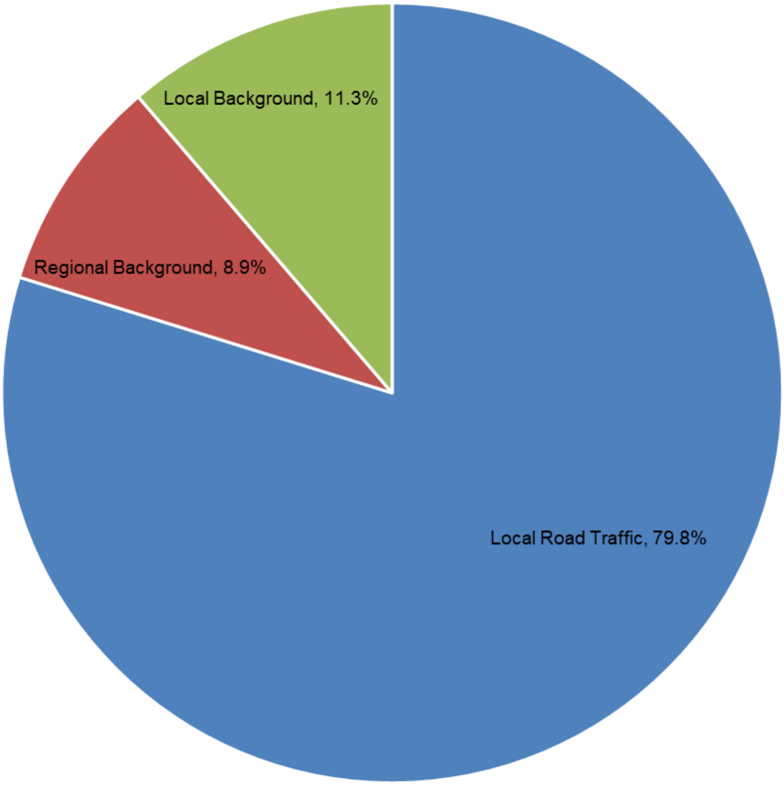
- Petrol and Diesel Cars
- Petrol and Diesel LGVs

- Rigid and Artic HGV
- Buses
- Motorcycle
- Full Hybrid Petrol Cars
- Plug-in Hybrid Petrol Cars
- Full Hybrid Diesel Cars
- EV Cars

Receptors were modelled within and within 20m of the boundary of the AQMA using ADMS Roads 5.1, Emissions Factors Toolkit (EFT) version 12.0[1] and road traffic data provided by Shropshire Council Highways Team[2] and Department for Transport (DfT) Road Traffic Statistics[3]. The full modelling methodology is available within the Bridgnorth AQMA Technical Report produced by Bureau Veritas[4] included in Appendix C.

The source apportionment modelling undertaken, identified that within the AQMA, the predominant source contributions were apportioned to local road traffic, specifically 80% when compared to regional and local background concentrations.

Figure 3-1 - Average NOx Background Split



From source apportionment analysis for the Bridgnorth AQMA, diesel cars account for the largest amounts of road NO_x (around 59%) with diesel LGVs and petrol cars the next largest contributors (16% and 10% respectively). As such, measures contained within the AQAP should focus on reducing emissions from these vehicle classes. The concentrations are detailed in Table 3-1 and Table 3-2.

Figure 3-2 - NOx Source Apportionment Average Across All Modelled Receptors

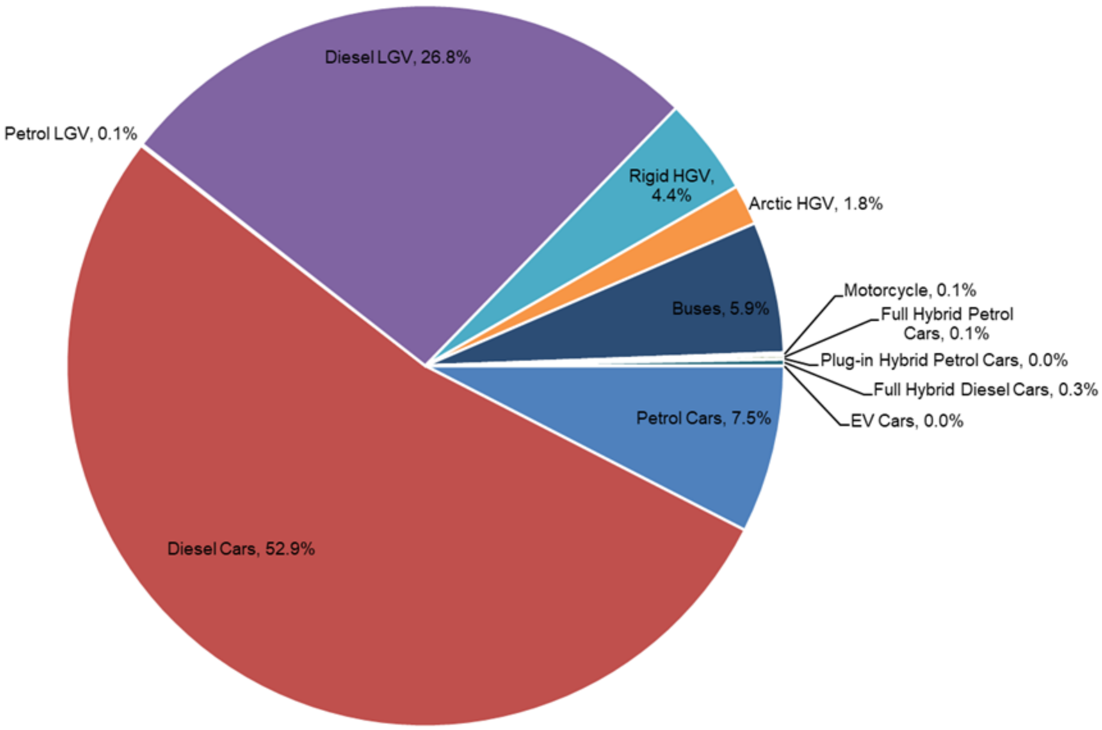


Table 3-1 – NOx Source Apportionment Results

Results	All Vehicles	Petrol Cars	Diesel Cars	Petrol LGV	Diesel LGV	Rigid HGV	Arctic HGV	Buses	Motorcycle	Full Hybrid Petrol Cars	Plug-in Hybrid Petrol Cars	Full Hybrid Diesel Cars	EV Cars	Background
Average Across All Modelled Receptors														
NOx Concentration (µg/m^3)	30.2	2.3	16.0	0.0	8.1	1.3	0.5	1.8	0.0	0.0	0.0	0.1	0.0	7.6
Percentage of Total NOx	79.8%	6.0%	42.2%	0.1%	21.4%	3.5%	1.4%	4.7%	0.1%	0.1%	0.0%	0.2%	0.0%	20.2%
Percentage Contribution to Road NOx	100.0%	7.5%	52.9%	0.1%	26.8%	4.4%	1.8%	5.9%	0.1%	0.1%	0.0%	0.3%	0.0%	-
At Receptor with Maximum Road NOx (25)														
NOx Concentration (µg/m^3)	87.0	6.9	46.6	0.1	23.6	3.4	1.4	4.5	0.1	0.1	0.0	0.3	0.0	7.6
Percentage of Total NOx	91.9%	7.3%	49.2%	0.1%	25.0%	3.5%	1.5%	4.8%	0.1%	0.1%	0.0%	0.3%	0.0%	8.1%
Percentage Contribution to Road NOx	100.0%	7.9%	53.6%	0.1%	27.2%	3.9%	1.6%	5.2%	0.1%	0.2%	0.0%	0.3%	0.0%	-

Table 3-2 – NO_2 Source Apportionment Results

Results	All Vehicles	Petrol Cars	Diesel Cars	Petrol LGV	Diesel LGV	Rigid HGV	Arctic HGV	Buses	Motorcycle	Full Hybrid Petrol Cars	Plug-in Hybrid Petrol Cars	Full Hybrid Diesel Cars	EV Cars	Background
Average Across All Modelled Receptors														
NO_2 Concentration ($\mu g/m^3$)	15.6	1.2	8.2	0.0	4.2	0.7	0.3	0.9	0.0	0.0	0.0	0.0	0.0	6.0
Percentage of Total NO_2	72.0%	5.4%	38.2%	0.1%	19.3%	3.2%	1.3%	4.2%	0.1%	0.1%	0.0%	0.2%	0.0%	28.0%
Percentage Contribution to Road NO_2	100.0%	7.5%	53.0%	0.1%	26.8%	4.4%	1.8%	5.9%	0.1%	0.2%	0.0%	0.3%	0.0%	-
At Receptor with Maximum Road NO_2 (25)														
NO_2 Concentration ($\mu g/m^3$)	42.1	3.3	22.1	0.0	11.2	1.6	0.7	2.1	0.1	0.1	0.0	0.1	0.0	6.0
Percentage of Total NO_2	87.4%	6.8%	45.9%	0.1%	23.3%	3.3%	1.4%	4.5%	0.1%	0.1%	0.0%	0.3%	0.0%	12.6%
Percentage Contribution to Road NO_2	100.0%	7.8%	52.5%	0.1%	26.6%	3.8%	1.6%	5.1%	0.1%	0.2%	0.0%	0.3%	0.0%	-

The above Tables and Figures detail the source apportionment results for NOx and NO_2 concentrations at modelled receptors for two scenarios:

- The average NOx and NO_2 contributions across all modelled locations representative of sensitive human exposure (called ‘receptors’). This provides useful information when considering possible action measures to test and adopt.
- The location where the maximum road NOx and NO_2 concentrations have been predicted within the AQMA. This is likely to be in the area of most concern within the proposed AQMA and so a good place to test and adopt action measures. Any gains predicted by action measures are likely to be greatest at this location and so would not represent gains across the whole modelled area.

When considering average NOx concentration across all modelled receptors locations, the following observations were found:

- Road traffic accounts for 79.8% (30.2µg/m^3) of the total average NOx with background concentrations accounting for 20.2% (7.6µg/m^3)
- Diesel cars account for 42.2% (16.0µg/m^3) of the total NOx and 52.9% of all the road traffic.
- Diesel LGVs account for 21.4% (8.1µg/m^3), the second largest contributor of the vehicle categories.

When considering average NO_2 concentration across all modelled receptors locations, the following observations were found:

- Road traffic accounts for 72.0% (15.6µg/m^3) of the total average NO_2 with background concentrations accounting for 28% (6.0µg/m^3)
- Diesel cars account for 38.2% (8.2µg/m^3) of the total NO_2 and 53.0% of all the road traffic.
- Diesel LGVs account for 19.3% (4.2µg/m^3), the second largest contributor of the vehicle categories.

When considering average NOx concentration at the max road receptor (2 Pound Street), the following observations were found:

- Road traffic accounts for 91.9% (87.0µg/m^3) of the total NOx with background concentrations accounting for 8.1% (7.6µg/m^3)
- Diesel cars account for 49.2% (46.6µg/m^3) of the total NOx and 53.6% of all the road traffic.
- Diesel LGVs account for 25.0% (23.6µg/m^3), the second largest contributor of the vehicle categories.

When considering average NO_2 concentration at the max receptor (2 Pound Street), the following observations were found:

- Road traffic accounts for 87.4% (42.1µg/m^3) of the total NO_2 with background concentrations accounting for 12.6% (6.0µg/m^3)
- Diesel cars account for 45.9% (22.1µg/m^3) of the total NO_2 and 52.5% of all the road traffic.
- Diesel LGVs account for 23.3% (11.2µg/m^3), the second largest contributor of the vehicle categories.

From the source apportionment it can be seen that road traffic is the main cause of elevated NO_2 concentrations with diesel cars the primary contributor and diesel LGVs the second largest contributor. As such measures proposed look to ease the number of private motor vehicles travelling through the AQMA and reduce congestion.

3.4 Required Reduction in Emissions

In line with the methodology presented in Box 7.6 of TG(22)[5], the necessary reduction in Road NOx emissions required to bring the current AQMA into compliance is shown in Table 3-3. This has been completed at the maximum annual mean concentration location which is receptor 21, this is also the maximum monitored concentration. The TG(22) procedure calculates the required reduction of road NOx to achieve a total NO_2 concentration of 40µg/m^3. However due to the uncertainty associated with diffusion tube monitoring, we have used a figure of 36.0µg/m^3 for total NO_2 concentration. Receptor 21 is located in Pound Street within the AQMA.

Table 3-3 – NOx Reduction Required

Metric	Concentration µg/m³
Maximum Modelled NO_2 Concentration (µg/m³)	48.1
Road NOx Concentration (µg/m³)	89.0
Required Road NOx Reduction (µg/m³)	29.0
Required Percentage Reduction	32.6%

3.5 Key Priorities

3.5.1 Priority 1 – Traffic Management

Through some of the public realm works that are being undertaken along High Street, located east of the AQMA, around 250m, measures to improve the traffic flow within the Bridgnorth AQMA are also include. This includes the installation of ANPR cameras to restrict the movement of HGVs through the AQMA to access only. Additional signage to direct traffic through the AQMA will also be installed which will aim to improve the flow of traffic through the AQMA.

3.5.2 Priority 2 – School Travel Plans

There are a number of schools that encompass the Bridgnorth AQMA. South of the AQMA is Castlefields Primary School, Oldbury Wells School and Bridgnorth Sixth Form. North East of the AQMA is Bridgnorth Endowed School, St John's Catholic Primary School and St Leonard's C of E Primary School. Shropshire Council understand that many vehicles that use to access these schools travel through the Bridgnorth AQMA, this includes not only private motor vehicles but buses too. Shropshire Council are looking to develop School Travel plans with these schools to help raise awareness and divert traffic away from the Bridgnorth AQMA.

3.5.3 Priority 3 – Low Town Park and Ride

The continuation of funding for the Low Town Park and Ride, previously trailed in 2015 and withdrawn in 2019 is supported by local residents and businesses. The park and ride previously operated on Saturdays to facilitate visits to the town centre and was withdrawn in 2019.

4 Development and Implementation of Bridgnorth AQAP

4.1 Consultation and Stakeholder Engagement

In developing/updating this AQAP, we have worked with other local authorities, agencies, businesses and the local community to improve local air quality. Schedule 11 of the Environment Act 1995 requires local authorities to consult the bodies listed in Table 4-1. In addition, we will undertake the following stakeholder engagement of the draft AQAP:

- Website
- Articles in local newspaper
- Letters inviting views to those currently affected by exceedances in the AQMA.

Consultation on the Air Quality Action Plan is expected to take place between March – June 2024. Details of the communication methods and stakeholder engagement will be detailed within the Final AQAP.

The response to our consultation stakeholder engagement is given in Appendix A: Response to Consultation.

Table 4-1 – Consultation Undertaken (TBC)

Consultee	Consultation Undertaken
The Secretary of State	Yes
The Environment Agency	Yes
The highways authority	Yes
All neighbouring local authorities	No
Other public authorities as appropriate, such as Public Health officials	Yes

Consultee	Consultation Undertaken
Bodies representing local business interests and other organisations as appropriate	Yes

4.2 Steering Group

A steering group was established with officers from Shropshire Council to identify and agree measures for inclusion within the AQAP which would benefit air quality within the Bridgnorth AQMA. The steering group includes officers which special interests in Environmental Protection, Climate Change, Highways, Communication, Policy, Economic Growth and Passenger Transport. These specialities all have a influence on air quality within Bridgnorth and therefore it is important to evaluate the most effective measures.

An initial steering group meeting was held on 12th January 2023 to discuss possible measures for Bridgnorth AQMA. Measures included alterations to the High Street and the Council applying for part 6 moving traffic contravention powers to issue PCNs, to encourage flowing traffic through the AQMA.

Throughout 2023 and 2024 discussions with the steering group have been ongoing to discuss the potential measure options and other ongoing strategies to collaborate with the Air Quality Action Plan.

The most recent discussions with the steering group were in February 2024 to discuss the progress of AQAP and the measures which should be implemented within Bridgnorth. Some of the key parties involved in these discussions were:

- Economic Growth Department
    - The development of the Future Bridgnorth Partnership (FBP) which will aim to explore and co-ordinate a number of projects within Bridgnorth to improve not only Air Quality but public realm, transport and local business needs.
- Passenger Transport (Buses)
    - Discussions regarding the potential uptake of EV buses or retrofitting of existing buses was undertaken. Many of the bus routes that occupy

Bridgnorth are long distance rural routes which are not ideal for electrification and could dissuade applications when it comes to tender. Initial costs of EV buses and retrofitting were provided.

- School Travel Planning
    - Details regarding funding for school travel plans to reduce the traffic that flows through the Bridgnorth AQMA to access the two schools in the south of Bridgnorth.
- Active Travel
    - LCWIP Measures have been discussed and the potential implementation within the Bridgnorth area.
- Highways Authorities
    - Ongoing discussions regarding feasible highway improvements to reduce congestion. Particularly looking at crossing points on Pound Street and Whitburn Street

It is the aim for this steering group to continue to communicate at regular intervals following the adoption of the AQAP. This is essential to provide progress reports on individual actions in relation to the AQAP measures, discuss any key lessons learnt from the continual implementation of the measures and to continue to discuss any new ideas in terms of future measures and actions within the borough.

The steering group will continue to meet prior to the submission of the Final Air Quality Action Plan to detail some of the key areas regarding costs and timescales for the implementation of some of the measures detailed below.

Having members within the steering group from different areas and departments allows a collaborative approach to improving air quality and provides a wider scope of measures that can be implemented.

5 AQAP Measures

Table 5.1 shows the Bridgnorth AQAP measures. It contains:

- a list of the actions that form part of the plan
- the responsible individual and departments/organisations who will deliver this action
- estimated cost of implementing each action (overall cost and cost to the local authority)
- expected benefit in terms of pollutant emission and/or concentration reduction
- the timescale for implementation
- how progress will be monitored

NB: Please see future ASRs for regular annual updates on implementation of these measures

5.1.1 Timescales of the AQAP Measures

Following discussions through the Air Quality Steering Group, many of the measures proposed within Bridgnorth are expected to be completed by 2025. These measures however are still undergoing review to determined finalised funding and implementation. As such it can be considered that these measures are at the planning stage. Most of the measures detailed in Table 5-1 are expected to be implemented at a quick pace, such as the school travel plans and the removal of the crossing on Whitburn Street.

However, finalised details on the timescales that measures will be implemented will be better understood when the final AQAP is submitted and the Shropshire 2024 Air Quality Annual Status Report will continue to detail the progression of these measures.

5.1.2 Air Quality Partners

One of the key Air Quality Partners that Shropshire Council have consulted with are the Highways Authorities. Due to the roads and junctions in question within the Bridgnorth AQMA under the Highways Authority, discussions on the measures that can be implemented to help reduce traffic and congestion within the AQMA have been undertaken. This includes discussions regarding the removal of junctions on Pound Street and Whitburn Street to help reduce congestion within the AQMA and smooth traffic. Discussions regarding the potential altercation to existing junctions are ongoing.

5.1.1 Future Measures to Maintain the Objective

It is considered that following the implementation of some of the measures detailed above with regard to the removal of the crossing on Whitburn Street, addition of the VMS and the adoption of school travel plans that the Air Quality Objective for NO_2 will be able to be maintained within the Bridgnorth AQMA. As shown in the monitoring data, there is currently a downward trend in annual mean NO_2 concentrations and following the adoption of these behavioural changes, public perception of Air Quality will help to further reduce emissions within the AQMA. In addition, the uptake of more electric vehicles will help to further ensure that concentrations within the AQMA remain below the AQO.

It should also be noted that following compliance of the Air Quality Objective for annual mean NO_2 then Shropshire Council will develop an Air Quality Strategy detailing the ongoing measures to continue to keep NO_2 concentrations below the AQO.

Table 5-1 – Air Quality Action Plan Measures

Measure No.	Measure	Category	Classification	Estimated Year Measure to be Introduced	Estimated / Actual Completion Year	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Target Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Potential Barriers to Implementation
1	School Travel Plans	Promoting Travel Alternatives	School Travel Plans	2024	2025	Shropshire Council	Active Travel England, DfT, Shropshire Council	No	Funded	£10k - £50k/	Planning	<0.5 µg/m3 reduction in the AQMA	Review of the adoption of School Travel plan and the associated reductions of traffic within the AQMA. Surveys to understand how students currently travel to school and the methods and routes they take.	Costs and Finalised dates to be confirmed following further discussions with Oldbury Wells School and Sixth Form and Castlefield Primary School	
2	LCWIP – Cycle and Walking path on Whitburn Street	Transport Planning and Infrastructure	Cycle Network	TBC	TBC	Shropshire Council, Highways	Active Travel England, DfT, Shropshire Council	No	Partially Funded	£50k - £100k/	Planning	<0.5 µg/m3 reduction in the AQMA	Uptake of cycling and walking to High Street as well as a review of the traffic flows within the AQMA after the measures is adopted.	Initial planning states, one of the routes within the LCWIP that is highly prioritise is the cycle path on Whitburn Street	

Measure No.	Measure	Category	Classification	Estimated Year Measure to be Introduced	Estimated / Actual Completion Year	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Target Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Potential Barriers to Implementation
3	ANPR along Pound Street	Traffic Management	Strategic Highways Improvements	TBC	TBC	Shropshire Council, Highways	TBC	No	TBC	TBC	Planning	<0.5 µg/m3 reduction in the AQMA	Review of the traffic flows during peak times and the subsequent monitoring results within the AQMA.	Ongoing discussion with the UK Share Prosperity Fund and considered within Public Realm work for Bridgnorth	Would require a Traffic Regulation Order. Further funding opportunities with S106 or Community Infrastructure Levy

6 Quantification of Measures

6.1 Assumptions

A few of the measures set out in Table 5-1 are very difficult to quantify due to the nature of the type of measures. This has resulted in some assumptions being made to help determine the potential impact of measures. A review of the literature and professional best judgement has been considered for measures such as the school travel plans, LCWIP and the ANPR as the potential changes in traffic flow within the AQMA is difficult to predict without detailed traffic modelling. Without this modelling no Air Quality Modelling can be undertaken.

For the measures associated with the removal of the zebra crossing on Whitburn Street, the introduction of the Tasley Gateway Park and Ride and the adoption of the VMS, modelled assumptions have been made which are detailed below however these measures were not progressed further.

6.1.1 Measure Quantification – Removal of Zebra Crossing on Whitburn Street – Not Progressed

One of the key measures within the Bridgnorth AQMA is the removal of the zebra crossing located on Whitburn Street. The crossing on Whitburn Street is located approximately 30m from the two mini-roundabouts located on the Salop Street/Pound Street/Whitburn Street Junction west and the Whitburn Street/Old Smithfield Junction located east. Currently the monitoring locations around this area of the AQMA from the 2022 dataset are just below the AQO for annual mean NO_2 of 40 µg/m^3. Although no modelled speeds for this road link were available from the appointed transport consultants, it is known that the road link is heavily congested due to the proximity of the junctions and the crossing. As such the modelled speeds of the Whitburn Street were reduced to support the model verification and the expected average speeds.

In order to demonstrate the modelled impacts of the removal of the crossing on Whitburn Street, the modelled speed of the road link was increased. The updated emissions were run in EFT v12.0 and the model updated using ADMS-Roads. Following the review of this, the removal of the crossing resulted in a 1.5µg/m^3 improvement at the worst-case receptor.

It should be noted that this was on the assumption that the speeds originally modelled were representative of the average speeds observed and the new speeds also representative of the projected improvement in the smoothing of traffic.

6.1.2 - Measure Quantification – Removal of Zebra Crossing on Pound Street and highways/landscaping to Shared Space realm – Not Progressed

Awaiting further quantification from estimated traffic speed data and confirmation of highway alterations.

6.1.3 Measure Quantification – Variable Messaging Signs – Not Progressed

Another quantified measure was the implementation of the variable messaging signs. This was implemented in a local authority nearby to Shropshire and although no modelled traffic information was available regarding the change in traffic and AADT associated with the VMS, the assumption that approximately 5-10% reduction in AADT within the AQMA was projected.

It is expected that the signs will be placed on the key routes into the AQMA detailing the other routes that can be taken to access particular locations, such as Low Town. Details regarding the peak congestion times could be displayed to encourage drivers to use alternate routes.

With this in mind, the ADMS-Roads model was updated to run two scenarios accounting for a 5% and 10% reduction in AADT within the AQMA. This was undertaken for the private vehicles only as it was expected that the VMS would unlike change existing bus, HGV and LGV routes.

As such if the VMS measures resulted in a 5% reduction in private vehicles in the AQMA this would result in a 1.2µg/m^3 reduction in the AQMA. If a 10% reduction was observed this would be a 2.5µg/m^3 reduction at the worst case receptor.

6.1.4 Measure Quantification – Park and Ride Tasley Gateway – Not Progressed

Following a review of the capacity and movements of the existing Park and Ride facilities operated in Shrewsbury and the understanding of the capacity of the new Park and Ride facility, the quantification of the reduction in NO_2 emissions was calculated. It was assumed that the capacity of the Park and Ride facility could result in a reduction of 500 private motor vehicles within the AQMA. Under this assumption, a reduction of 500 private motor vehicles was applied across the AQMA. After calculating the updated emissions using EFT v12.0, this was then modelled using ADMS-Roads and resulted in a reduction of 1.10 µg/m^3 decrease in annual mean NO_2 concentrations.

This modelling was on the basis on the reduction of 500 private motor vehicles within the AQMA. It was also assumed that the buses that would operate at the Park and Ride facility would be electric buses, hence the conservative method of removing 500 private vehicles and not increasing the proportion of buses. An estimation method of adding 10 new buses to the vehicle fleet as well at the reduction in 500 private motor vehicles was also undertaken. This resulted in a 1.03 µg/m^3 reduction in NO_2 concentrations at the worst case receptor within the Bridgnorth AQMA.

6.1.5 Measure Quantification – Update of EV Buses or Retrofitting Buses to Euro 6 – Not Progressed

One of the measures that was quantified but not progressed was the potential update of EV buses or retrofitting of buses to Euro 6. Buses within Bridgnorth account for around 7.8% of total Road NO_x emissions. A review of the uptake of a range of 25 or 50 EV buses or 25 or 50 retrofitting of buses was undertaken and quantification of the reduction of NO_2 concentrations at the worst-case receptor was undertaken.

To update the emissions associated with EV buses, the Tag Data Book in EFT was updated. The base UK fleet for 2022 is detailed below. The proportions of the PSV EV and Diesel contributions were then updated based on the shift in the number of buses that would be EV. These new emissions were then modelled in ADMS-Roads with the impact of 25 EV buses resulting in a 1.2µg/m^3 reduction in NO_2 emissions and 50 EV buses a 2.2µg/m^3 reduction.

Figure 6-1 – 2022 UK base fleet in EFT

Year	2022										
			OK								
Cars			LGV			OGV1		OGV2		PSV	
Petrol	Diesel	Electric	Petrol	Diesel	Electric	Diesel	Electric	Diesel	Electric	Diesel	Electric
49%	36%	15%	2%	96%	2%	100%	0%	100%	0%	84%	16%
OK			OK			OK		OK		OK	

To calculate this for the retrofitting of buses to become Euro 6 standard, the Bespoke Euro Fleet option within EFT v12.0 was used. The below is based on the standard national UK fleet. The ratios were then updated on the bases of 25 or 50 new Euro 6 buses. This resulted in a modelled reduction in NO_2 concentrations of 1.1µg/m^3 for 25 buses and 1.7µg/m^3 for 50 buses.

Overall due to the cost of both new EV buses and associated infrastructure as well as the retrofitting of buses the measures was not considered feasible and not pursued.

Figure 6-2 – Bespoke Euro Fleet Option Snapshot from EFT

Heavy Duty Vehicles	Pre-Euro I	Euro I	Euro II	Euro III	Euro IV	Euro V_EGR	Euro V_SCR	Euro VI	Euro II SCRRF	Euro III SCRRF	Euro IV SCRRF	Euro V SCRRF to EGR
Rigid HGVs	-	-	0.01	0.03	0.03	0.03	0.10	0.79	-	-	-	-
Artic HGVs	-	-	0.00	0.00	0.01	0.01	0.04	0.93	-	-	-	-
Conventional Buses	-	-	0.01	0.04	0.06	0.06	0.17	0.67	-	-	-	-
Hybrid Buses					-	0.20	0.60	0.20				
Conventional Coaches	-	-	0.01	0.04	0.06	0.06	0.17	0.67	-	-	-	-
Hybrid Coaches					-	0.20	0.60	0.20				

6.2 Cost Benefit Analysis of Measures

6.2.1 Methodology

Using the above assumptions around the quantitative pollution reduction and assumed costs, each measure was given a score as set out below.

Table 6-1 – Cost Score

Estimated Cost of Measure	Score
< £10k	7
£10k - £50k	6
£50k - £100k	5
£100k - £500k	4
£500k - £1m	3
£1m - £10m	2
> £10m	1

Table 6-2 – Benefit Score

Estimated Reduction in Pollutant Concentrations	Score
>0.5µg/m^3	1
0.5-1µg/m^3	2
1-2µg/m^3	3
2-3µg/m^3	4
3-4µg/m^3	5
4-5µg/m^3	6
>5µg/m^3	7

Using the scores above, the below matrix was implemented to work out the cost-benefit. Higher scores are awarded for those measures which are cheapest with the greatest effect, with the lowest scores awarded for those which will be costly with limited reduction in pollution.

Table 6-3 – Cost Benefit Scoring Matrix

		Estimated Reduction in Pollutant Concentrations						
		>0.5µg/m³	0.5-1 µg/m³	1-2 µg/m³	1-2 µg/m³	2-3 µg/m³	3-4 µg/m³	>4 µg/m³
Cost of Measure	< £10k	8	9	10	11	12	13	14
	£10k - £50k	7	8	9	10	11	12	13
	£50k - £100k	6	7	8	9	10	11	12
	£100k - £500k	5	6	7	8	9	10	11
	£500k - £1m	4	5	6	7	8	9	10
	£1m - £10m	3	4	5	6	7	8	9
	> £10m	2	3	4	5	6	7	8

The analysis should also account for the feasibility of implementing the measures, with those likely to progress given a higher priority than those which are acknowledged to be a challenge to implement. The feasibility score factors in local influences such as political backing, accessibility to funding options and resources available. As such, each measure was assigned a 'Feasibility score based on the table below. The score from the matrix was multiplied by this score.

Table 6-4 – Feasibility Scores

Feasibility Score	Score
Measure has already been started and just requires progressing	7
Very easy to implement, and political support, sufficient resources	6
Relatively easy to implement, resources available	5
Possible to implement but may require some learning/campaigning, moderately time intensive	4
Challenging but still feasible, may require additional support and resources	3
Difficult to implement, no political appetite, time and resource intensive	2
Very difficult to implement, no political appetite, time and resource intensive	1

6.2.2 Cost-Benefit Analysis

Following the above assessment, it has been possible to rank the measures by cost, benefit and feasibility, this is shown in Table 26 below. With the feasibility weighting meaning that measures which are the easiest to progress are scored higher, these are prioritised.

Table 6-5 – Cost Benefit Analysis of Measures

Measure No.	Measure	Cost Score	Air Quality Effect Score	Feasibility Score	Overall Score
1	School Travel Plans	6	1 (>0.5µg/m³)	6	13
2	LCWIP – Cycle and Walking path on Whitburn Street	5	1(>0.5µg/m³)	6	12
3	ANPR Along Pound Street	4	1(>0.5µg/m³)	3	8

6.3 Year of Objective Compliance

The Detailed modelling report has used the assessment methodology within TG(22) to provide an estimated year of compliance with only national measures being taken into account of 2028 based on the 2022 monitoring data. This was undertaken using the NO_2 projection factor tool provided by Defra.

Shropshire Council aims that the implementation of the outlined measures will result in the relevant objective(s) being attained by 2027. This is based on the measures detailed in Table 6.1 being implemented as well as the general improvements in NO_2 concentrations and decreasing trends.

Appendix A: Response to Consultation

Table A.1 – Summary of Responses to Consultation and Stakeholder Engagement on the AQAP- To be updated following consultation

Consultee	Category	Response
Future Bridgnorth Group	Local Business and Public within Bridgnorth	The future Bridgnorth Group were positive about the general detail of the Bridgnorth AQAP as well as the measures detailed within the plan. There were some questions raised regarding the proposals to remove the pedestrian crossings along Whitburn Street and Pound Street as it would limit the crossings within Bridgnorth and effect local business. The Future Bridgnorth Group were also against restricting the movements of LGVs to certain times of the day for the same reason of reducing local business efforts.

Appendix B: Reasons for Not Pursuing Action Plan Measures

Table B.1 – Action Plan Measures Not Pursued and the Reasons for that Decision

Action category	Action description	Reason action is not being pursued (including Stakeholder views)
Traffic Management	New traffic light system within AQMA	A review of introducing new traffic lights where the current mini roundabouts are located was proposed. Although no detailed modelling was undertaken it was considered that the traffic light system would result in more idling of vehicles and increase the congestion on certain links.
Promoting Low Emission Transport	Update of New EV Buses or Retrofitting of Buses to Euro 6	A review of the update of up to 50 EV buses or retrofitting 50 buses to Euro 6 standards was undertaken. Modelling of the potential air quality improvements was undertaken and detailed above, however on review of the costs it was determined that funding would prove difficult and based

		on the benefits projects would not be feasible. High level disucsiosns were held with the Bus operators, however due to a funding issue it was not deemed feasible.
Transport Planning and Infrastructure	Create alternative access to Oldbury Wells School/Sixth Form from A458	Proposal is not seen as feasible due to the likely prohibitive costs, and difficulties making a vehicle access across the height difference between the school and A458 (below surrounding ground level in cutting).
Transport Planning and Infrastructure	Introduce a layby / dropping-off point on A458 and introduce Pedestrian/Active Travel routes to Oldbury Wells School and Sixth Form and Castlefields Junior School.	Potential, but many unknowns, would require further assessment and cost-benefit analysis
Promoting Travel Alternatives	Formation of alternative pedestrian access to school from Severn Valley Railway Car Park.	Not supported - complex access through Severn Valley Railway site, landowner clarity required, potential relocation of parking issue, within same area - benefit for air quality in AQMA is less certain.

Promoting Travel Alternatives	Shared Space - Highway and Public Realm on Pound Street	Potential support - can be combined/compliment existing planned public realm improvements in Bridgnorth.
Transport Planning and Infrastructure	One-Way System - Pound St /	Considered at scoping level only - Not supported, would direct traffic into town centre - counter to future plans for Bridgnorth town centre, unlikely to garner political support. Potential to generate other air quality hotspots on narrow streets.
Traffic Regulation Order for HGVs and LGVs	Review of the time periods and size of vehicle being HGV or LGV that would travel through Bridgnorth AQMA	A review of the LGV and HGV movements through the Bridgnorth AQMA was undertaken. As detailed within the source apportionment, LGVs are the 2^{nd} Highest contributing vehicle type for NOx emissions at the worst case receptor and across the AQMA. After initial consultation with local businesses in the area it was deemed this measures not suitable as it would restrict vehicle

		movements and was perceived negative to local business growth.
Traffic Management	Removal of Zebra Crossing on Whitburn Street	Negative opinions from residents and safety concerns
Traffic Management	Removal of Zebra Crossing on Pound Street and highways/landscaping to Shared Space realm	Negative opinions from residents and safety concerns
Public Information	Variable Messaging Signs	Limited space to install signs and impact on behaviour expected to be limited
Tasley P&R	Promoting Alterative Transport	Timescales to implement will not lead to significant air quality benefit

Appendix C: Bridgnorth AQAP Technical Modelling Report

Shropshire Council AQAP – Bridgnorth AQMA

Detailed Modelling Study

May 2024

Move Forward with Confidence

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Document Control Sheet

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Executive Summary

Shropshire Council has commissioned Bureau Veritas to complete a review of one of the Council's existing Air Quality Management Areas (AQMAs) to support in the development of a new Air Quality Action Plan. The Council currently has two AQMA designations, both of which have been declared for exceedances of the annual mean for Nitrogen Dioxide (NO_2). This detailed assessment focuses on the 'Bridgnorth AQMA', described as 'an area encompassing Pound Street and the junction of Whitburn Street and Salop Street'.

The aim of this Technical Note is to identify the extent to which the annual mean objective for NO_2 is exceeded within the AQMA, and to determine the exposure at sensitive receptors. The Technical Note also identifies the contribution from different vehicle classes so that the measures adopted can be targeted towards the main pollutant sources.

A dispersion modelling assessment has been completed and NO_2 concentrations have been predicted across all relevant areas at both specific receptor locations, and across a number of gridded areas, to allow the production of concentration isopleths. This has been used to supplement local monitoring data to provide a clear picture of the NO_x and NO_2 pollutant conditions within the Bridgnorth AQMA.

Following the completion of the analysis of both monitoring data and modelled concentrations across the assessed area, the following conclusions have been made for the Bridgnorth AQMA:

- Detailed modelling has predicted exceedances within the Bridgnorth AQMA of a maximum NO_2 concentration of 48.1 µg/m^3. All exceedances were observed along Pound Street.
- No exceedances of the NO_2 annual mean objective of 40 µg/m^3 were predicted outside of the current AQMA boundary.
- Based upon the analysis of results, it is recommended that the AQMA remains in place with the current boundary and monitoring should continue in this area.
- Overall, diesel cars accounted for the majority of NO_x emissions in the AQMA, followed by diesel LGV's and petrol cars.

The next steps upon completion of this Technical Note are to develop, through consideration of merit, a defined set of achievable measures to be brought forward into the revised action plan document.

1 Introduction

Shropshire Council ("the Council") has commissioned Bureau Veritas to complete a review of one of the Council's existing Air Quality Management Areas (AQMAs) to help in the development of a new Air Quality Action Plan (AQAP). The AQMA which this detailed study is related to is the Bridgnorth AQMA which is described as 'an area encompassing Pound Street and the junction of Whitburn Street and Salop Street'. This AQMA was declared in April 2005 and Local Air Quality Management Policy Guidance (22)[1] recommends that as a minimum, Local Authorities should revise their AQAP every 5 years.

The current AQAP that covers both Shrewsbury and the Bridgnorth AQMA was published in September 2008. Therefore, although work has been ongoing since the declaration of the AQMA, a detailed assessment has been undertaken to provide further information in support of preparation of the new AQAP.

The geographical extent of the AQMA included in this assessment is shown in Figure 1-1. Details of the Bridgnorth AQMA are as follows:

- **Extent**: an area encompassing Pound Street and the junction of Whitburn Street and Salop Street
- **Declared:** April 2005
- **Pollutant:** Nitrogen Dioxide (NO_2) Annual Mean

Figure 1-1 - Bridgnorth AQMA

[1] Local Air Quality Management Policy Guidance LAQM PG(22) – August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.

1.1 Scope of Report

This technical note seeks, with reasonable certainty, to predict the magnitude and geographical extent of any exceedances of the Air Quality Strategy (AQS) objectives, providing the Council with updated modelling data that can be utilised for the development and/or updates to specific measures that are to be included within the updated AQAP.

The areas considered as part of this study are illustrated in the figures presented throughout. The following are the main objectives of this technical note:

- To assess the air quality at selected locations (receptors) at areas of relevant exposure, representative of worst-case exposure within, and close to the existing AQMA boundary, based on modelling of emissions from road traffic on the local road network.
- To determine the geographical extent of any potential exceedances of the annual mean AQS objective for NO_2.
- To determine the relative contributions of separate vehicular source types to the overall pollutant concentrations through the completion of a source apportionment study.
- To put forward recommendations as to the extent of any changes to the current AQMA boundary and any changes to the declaration of the specific AQMA.

The approach adopted in this assessment to determine the impact of road traffic emissions on air quality utilised the atmospheric dispersion model ADMS-Roads version 5.0.1, focusing on emissions of oxides of nitrogen (NO_x), which comprise nitric oxide (NO) and NO_2.

In order to provide consistency with the Council's own work on air quality, the guiding principles for air quality assessments as set out in the latest guidance and tools provided by Defra for air quality assessment (LAQM Technical Guidance (22)[2]) have been utilised.

[2] Local Air Quality Management Technical Guidance LAQM TG(22) – August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.

2 Assessment Methodology

To predict the pollutant concentrations emitted from road traffic sources, atmospheric modelling was carried out using ADMS Roads version 5.0.1, developed by Cambridge Environmental Research Consultants (CERC). The approach used was based upon the following:

- Prediction of NO_2 concentrations to which existing receptors may be exposed and comparison with the relevant AQS objectives.
- Quantification of relative NO_2 contribution attributable to separate vehicular sources in relation to overall NO_x and NO_2 pollutant concentration.
- Determination of the geographical extent of any potential exceedances in regard to the existing AQMA boundary.

Concentrations of NO_2 have been predicted for a base year of 2022, with model inputs relevant to the assessment based upon the same year. The use of 2022 data was based on professional judgement that the impacts on road traffic that occurred as a result of the COVID-19 pandemic are no longer as significant as that observed throughout 2020 and 2021. To demonstrate, the Air Quality Expert Group (AQEG)[3] estimated that during the initial lockdown period in 2020, within urbanised areas of the UK, reductions of between 20-30% were observed in the NO_2 annual mean concentration. However, with no restrictions on travel in place during 2022, it has been determined that the traffic data of 2022 is likely to be similar to that observed prior to the COVID-19 pandemic, reflecting normal vehicle activity.

2.1 Traffic Inputs

Traffic counts for the road links included within the model have been completed by Streetwise Services Ltd. This data source provides an ATC for the relevant road link in terms for a number of vehicle types; cars, LGVs (light goods vehicles), HGVs (heavy goods vehicles), buses and coaches, and motorcycles.

Traffic data for modelled road links within the Bridgnorth AQMA were provided by Streetwise Services Ltd. This data was based on Automatic Traffic Count (ATC) data from 2022 where the appointed transport consultant confirmed the data could be used as AADT.

Full details of the traffic data used in the dispersion model are shown in Appendix A.

Traffic speeds were modelled at the relevant speed limit for each road. However, in accordance with LAQM.TG(22), where appropriate, traffic speeds have been reduced to simulate queues at junctions, traffic lights and other locations where queues or slower traffic are known to occur.

The Emissions Factors Toolkit (EFT) version 12.0[4] has been used to determine vehicle emissions factors for input the ADMS-Roads model. The emissions factors are based upon the traffic data inputs used within the assessment.

2.2 General Model Inputs

A site surface roughness value of 1 m was entered into the ADMS-roads model, consistent with the nature of the modelled domain. In accordance with CERC's ADMS Roads user guide[5], a minimum Monin-Obukhov Length of 30 m was used for the ADMS Roads model to reflect the urban topography of the model domain.

One year of hourly sequential meteorological data from a representative synoptic station is required by the dispersion model. For the completion of the modelling, 2022 meteorological data from the Shawbury weather station has been utilised within this assessment. This particular site has been

[3] Air Quality Expert Group, Estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19 outbreak in the UK, June 2020

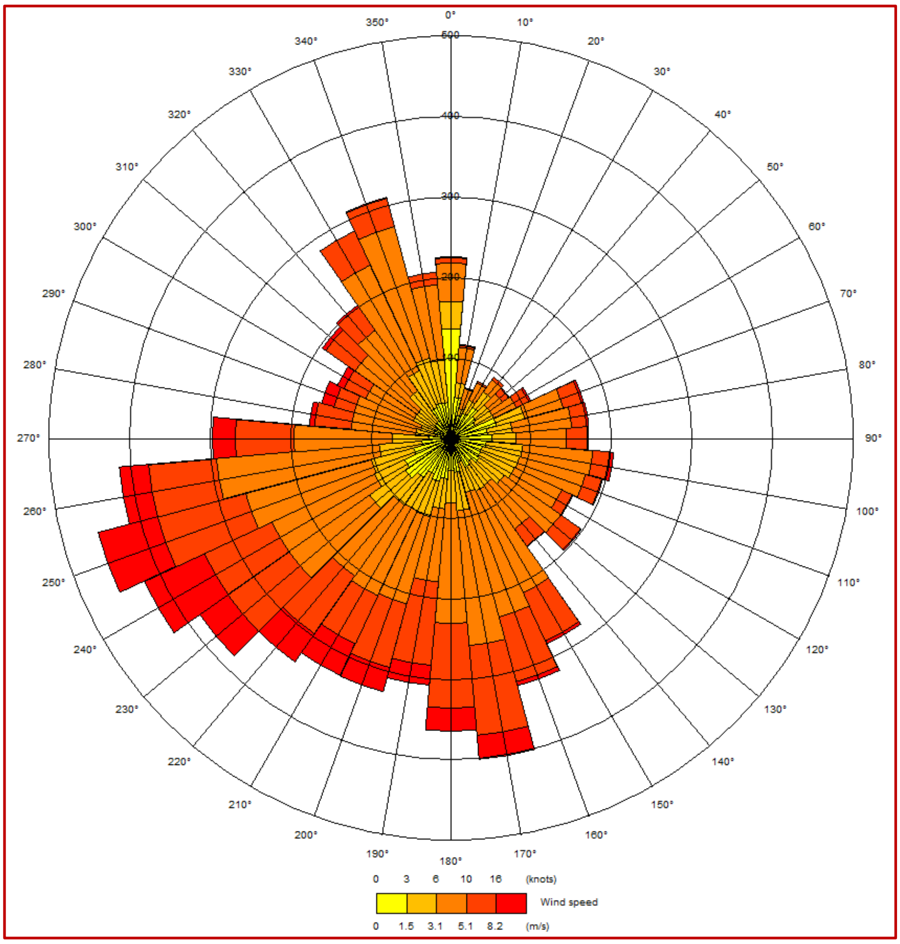
[4] Defra, Emissions Factors Toolkit – version 12.0 (2023), available at: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/

[5] CERC (2020), ADMS-Roads User Guide Version 5.

chosen due to it being the nearest site with a complete data set for 2022 and is representative of the Shropshire Council area.

A wind rose for this site for the year 2022 is presented in Figure 2-1. From this wind rose, it is evident that the prevailing wind within Shropshire is from the south-west, with an average wind speed of 2.6 m/s.

Figure 2-1 - Wind Rose for Shawbury 2022 Meteorological Data



2.3 Modelled Road Sources

A total of 8 road sources were included throughout the model domain, with the majority of the road sources being junctions or approaches to junctions (slow downs). No point sources have been included within the model under the assumption that road traffic is the primary source of NO_2 emissions. The road links modelled are presented in Figure 2-2 and include the main roads that pass through the AQMA.

Street canyons were also included along some stretches of road where the roads are surrounded by buildings/walls on both sides. A street canyon was modelled along Whitburn Street and Pound Street.

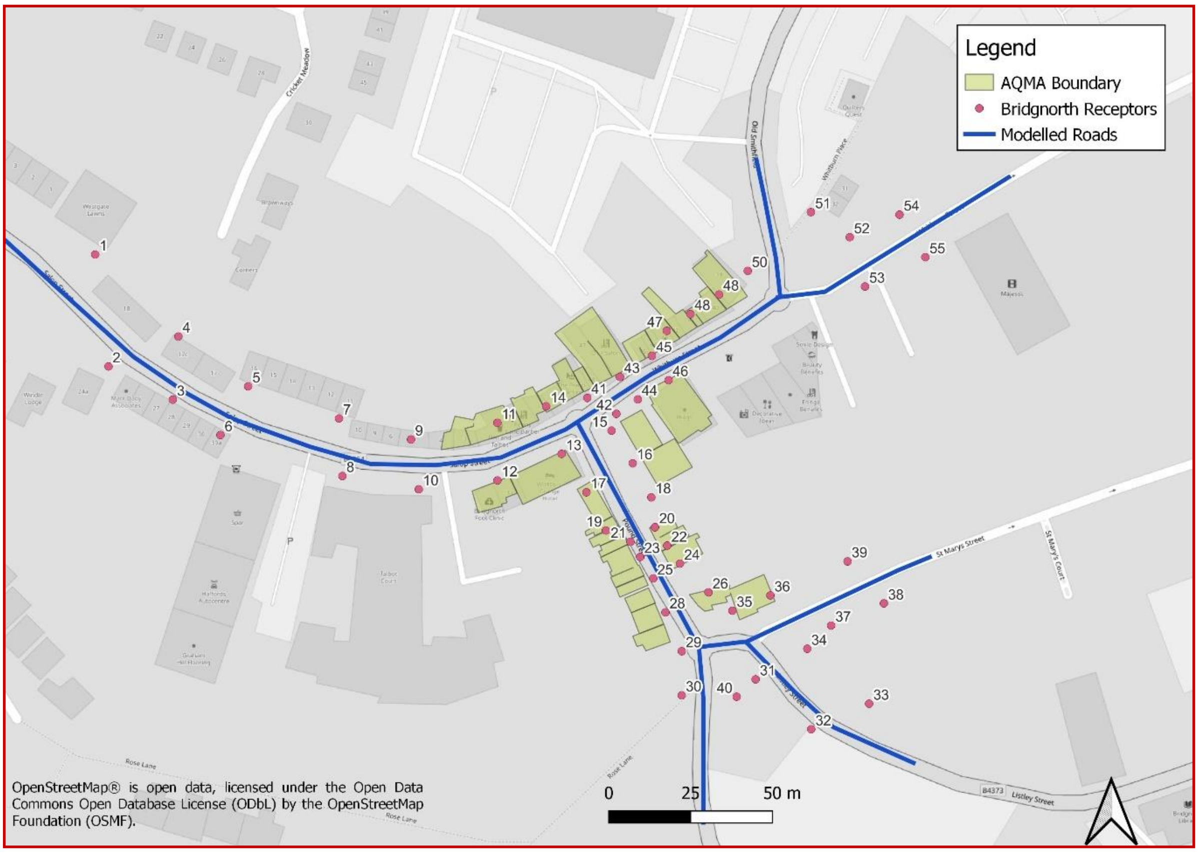
2.4 Modelled Sensitive Receptors

A total of 55 discrete receptors were included within the assessment to represent locations of relevant exposure. The locations were identified through completion of a desktop study, and included places such as residential properties, care homes, and schools. All receptors were modelled at 1.5 m to represent the typical breathing zone height. A description of the receptors is provided in Table 2-1, with their locations shown in Figure 2-2.

Table 2-1 - Modelled Receptor Locations

Receptor ID	Receptor Description	Receptor ID	Receptor Description
1	18 Salop Street	29	Squirrel Court
2	24a, Salop Street	30	Rose Lane
3	28, Salop Street	31	43a Listley Street
4	17c, Salop Street	32	45a Listley Street
5	16, Salop Street	33	4 Listley Street
6	30a, Salop Street	34	34 St Marys Street
7	11, Salop Street	35	The Old Smithy St Marys Street
8	38 Talbot Court	36	31 St Marys Street
9	5, Salop Street	37	37 St Marys Street
10	17 Talbot Court, Salop Street	38	40 St Marys Street
11	2, Salop Street	39	30a St Marys Street
12	33, Salop Street	40	43a Listley Street
13	Whitburn Grange Hotel, Salop Street	41	49, Whitburn Street
14	1, Salop Street	42	48, Whitburn Street
15	25 Pound Street	43	47, Whitburn Street
16	23 Pound Street	44	46 Whitburn Street
17	Whitburn Grange Hotel, Salop Street	45	45, Whitburn Street
18	21 Pound Street	46	46, Whitburn Street
19	2 Pound Street	47	43, Whitburn Street
20	19 Pound Street	48	41, Whitburn Street
21	4 Pound Street	48	40, Whitburn Street
22	18 Pound Street	50	39, Whitburn Street
23	5 Pound Street	51	Quilters Quest, Whitburn Place
24	16 Pound Street	52	32, Whitburn Street
25	7 Pound Street	53	8 Carpenters Court
26	14 Pound Street	54	31, Whitburn Street
27	12 Pound Street	55	1 Carpenters Court
28	9 Pound Street		

Figure 2-2 - Modelled Road Sources & Sensitive Receptors



2.5 Model Outputs

Background pollutant values for 2022, derived from Defra Background Maps[6], have been used in conjunction with the concentrations predicted by the ADMS-Roads model to calculate predicted total annual mean concentrations of NO_x.

For the prediction of annual mean NO_2 concentration for the modelled scenarios, the output of the ADMS-Roads model for road NO_x contributions have been concentrated to total NO_2 following the methodology in LAQM.TG(22), using the NO_x to NO_2 conversion tool developed on behalf of Defra. This assessment has utilised the most up-to-date version of the NO_x to NO_2 conversion tool, v8.1[7].

Verification of the model has been carried out using the majority of local authority NO_2 passive monitoring locations within the Bridgnorth AQMA, in accordance with the methodology detailed within LAQM.TG(22). In total, only the roadside passive (diffusion tube) monitoring site DF13 was excluded for model verification. DF13 monitored an NO_2 concentrations that was 10 µg/m^3 lower than monitoring site DF71, which is located around 5m north and exceeds the AQO. It was considered that although there are canyon effects observed on Pound Street where both sites are located, that due to a small 0.5m gap in the buildings where DF13 is located that there could be potential microclimate dynamics that were resulting in lower observed concentrations and could not be replicated in model. As such, a conservative approach was taken and DF13 was excluded from the model verification.

It should be noted that due to the incline observed on Pound street a 10% gradient was applied to the road through the EFT v12.0.1 function when calculating vehicle emissions.

Overall, of the monitoring locations within the Bridgnorth AQMA, the locations and heights of these tubes have been adjusted within the model and validated where required via a desktop study.

[6] https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

[7] Defra, NO_x to NO_2 Calculator. (2020). Available at: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/

2.6 Source Apportionment

To help inform the development of measures as part of the action plan stage of the project, a source apportionment exercise was undertaken for the following vehicle classes:

- Petrol and Diesel Cars;
- Petrol and Diesel LGV's;
- Rigid and Artic HGV;
- Buses;
- Motorcycle;
- Full Hybrid Petrol Cars;
- Plug-in Hybrid Petrol Cars;
- Full Hybrid Diesel Cars; and
- EV Cars

This provides vehicle contributions of NO_x as a proportion of the total NO_x concentration, which will allow the Council to develop specific AQAP measures targeting a reduction in emissions from specific vehicle types. A breakdown of vehicle class was provided by the appointed transport consultant (Streetwise Services Ltd) completing the traffic counts on each road link included within the model.

It should be noted that emission sources of NO_2 are dominated by a combination of direct NO_2 (f-NO_2) and oxides of nitrogen (NO_x), the latter of which is chemically unstable and rapidly oxidised upon release to form NO_2. Reducing levels of NO_x emissions therefore reduces concentrations of NO_2. Consequently, the source apportionment study has firstly considered the emissions of NO_x, which are assumed to be representative of the main sources of NO_2, and secondly emissions of NO_2.

With regards to the discrete receptor locations, consideration has been given to the following groups of receptors located within the AQMA and those within 20 m of the boundary. The source apportionment study has evaluated the following receptor combinations:

- The average NO_x and NO_2 contributions across all modelled locations (i.e., all locations covered by the model, both within and outside of the AQMA boundary). This provides useful information when considering possible action measures to test and adopt. It will however understate road NO_x concentrations in problem areas as results are averaged out across areas with higher and lower concentrations.
- The NO_x and NO_2 contributions at the receptor with the maximum road NO_x and NO_2 contribution. This provides a comparison to the previous two groups, with the identification of the most prominent vehicle source at receptor with the highest predicted NO_2 concentration.

3 Modelling Results

The following section provides a detailed assessment of the 'Bridgnorth AQMA', comparing monitoring completed over an 8-year period (2015-2022) with the modelled concentrations of annual mean NO_2. Details of each monitoring location and the monitoring results have been provided by Shropshire Council. Analysis of receptor locations has been completed both within and outside of the existing AQMA designation to determine the level of exceedance within the AQMA and also if there are any areas outside of the current boundary where the annual mean concentration of NO_2 is predicted to exceed the annual mean objective.

In line with the standardised LAQM reporting, the tabulated results present any exceedance of the annual mean AQS objective of 40 µg/m^3 in **bold**, and any predicted concentrations in exceedance of 60 µg/m^3 underlined and in **bold**. Additionally, annual mean concentrations that are predicted to be within 10% of the objective are presented in *italics* to ensure that any uncertainty in relation to the predicted modelling concentrations is taken into consideration for any recommendations made in terms of AQMA designation, amendment or revocation.

In addition, the NO_x source apportionment results which have been split across the vehicle classifications detailed in Section 2.6 are presented in both tabular and pie chart formats. This allows the main vehicular sources to be identified within the 'Bridgnorth AQMA', therefore aiding the development of measures that are of specific relevant to the AQMA.

3.1 Shropshire Council Monitoring Data

Table 3-1 presents the monitoring data collected by Shropshire Council. This table presents the data for the diffusion tubes within the Bridgnorth AQMA, as well as those surrounding the AQMA to provide a wider context for the monitoring results.

Table 3-1 - Passive NO_2 Monitoring Within and Around Bridgnorth AQMA

Site ID	Location	OS Grid Ref X	OS Grid Ref Y	Annual Mean NO_2 Concentration (µg/m^3)							
				2015	2016	2017	2018	2019	2020	2021	2022
DF13	Pound Street	371345	293081	**41.9**	**41.5**	**44.0**	**40.5**	35.6	30.3	33.1	30.1
DF27	Smithfield	371397	293179	26.5	27.8	28.2	26.0	25.8	19.7	23.6	15.8
DF28, 602	50 Whitburn Street	371297	293108	**51.2**	**52.9**	**40.3**	**48.2**	**43.4**	Relocated	Relocated	35.8
DF29	Adj Rutters	371397	293179	29.0	29.7	29.4	28.9	28.5	21.6	23.9	23.3
DF71	6 Pound Street, (On Pelican Crossing)	371346	293086	-	-	**58.5**	**50.9**	**49.1**	**40.8**	**43.2**	**41.5**
DF72	Mini Roundabout Listley Street (lamp column)	371375	293066	-	-	-	30.0	28.2	22.4	23.8	22.6
DF73	18 Pound Street (Downspout)	371354	293089	-	-	-	34.1	34.2	26.5	28.7	27.3
DF74	Lamp Column 9 (Steps of new build)	371340	293125	-	-	-	30.9	29.4	22.7	25.2	24.4
DF75	Lamp Column 48 (New Build)	371345	293106	-	-	-	30.9	27.6	22.4	24.1	23.9
DF76	Higgs/Stanton Ralph (Opp 45 Whitburn Street)	371366	293146	-	-	-	33.8	31.8	28.4	28.8	29.5
DF77	39/40 Whitburn Street Lamp Column	371375	293161	-	-	-	**40.3**	*38.7*	30.4	29.9	29.2
DF78	Pedestrian Crossing outside 42 Whitburn Street	371360	293152	-	-	-	*39.9*	*38.5*	32.2	35.9	32.9
DF79	Chill Salon Downspout between green and black door	371346	293143	-	-	-	**48.8**	**42.3**	35.3	*36.9*	35.6
DF80	48 Whitburn Street Downspout	371334	293139	-	-	-	**50.3**	**43.6**	*37.2*	**40.3**	*37.5*
DF81	Stretton House 3 Salop Street Downspout	371288	293119	-	-	-	28.8	26.7	20.1	23.3	21.3
DF82	Pedestrian Crossing outside 8 Salop Street	371264	293120	-	-	-	27.4	22.7	17.0	20.4	19.1
DF83	Downspout Of 2 Pound Street Bridgnorth	371341	293096	-	-	-	-	-	-	-	**47.8**

The data show that the NO_2 annual mean objective of 40 µg/m^3 has been exceeded at two diffusion tube sites within the Bridgnorth AQMA in 2022. DF71 which has exceeded the NO_2 annual mean objective since monitoring began in 2017 and a new monitoring site on Pound Street, DF83.

The areas of the AQMA that exceed the AQO based on the monitoring data above are situated close to junctions and where there are slight road canyon effects due to the narrow streets. The observed exceedances are therefore likely the result of the stopping and starting/idling of vehicles as traffic builds up along the road where the diffusion tube is located on approach to the junction, as well as the street canyon effects and incline of the road, reducing the dispersion of pollutants.

3.2 Modelled Receptor Concentrations, Annual Mean NO_2

Table 3-2 provides the modelled annual mean NO_2 concentrations predicted at existing receptor locations in 2022. Of the 55 receptors included in the assessment, 30 are located within the AQMA boundary whilst the remaining are situated on the modelled roads that lead into the AQMA.

Table 3-2 - Modelled Receptor Concentrations, Annual Mean NO_2

Receptor ID	OS Grid X	OS Grid Y	Height (m)	In AQMA?	AQS objective (µg/m^3)	2022 Modelled Annual Mean NO_2 (µg/m^3)	% of AQS objective
1	371182	293179	1.5	N	40	10.33	25.83
2	371186	293145	1.5	N	40	10.93	27.33
3	371205	293135	1.5	N	40	12.94	32.35
4	371207	293154	1.5	N	40	15.05	37.63
5	371228	293139	1.5	N	40	16.13	40.33
6	371220	293124	1.5	N	40	12.45	31.13
7	371256	293129	1.5	N	40	17.51	43.78
8	371257	293111	1.5	N	40	14.60	36.53
9	371278	293122	1.5	N	40	18.64	46.60
10	371280	293107	1.5	N	40	16.24	40.60
11	371304	293127	1.5	Y	40	23.00	57.50
12	371304	293110	1.5	Y	40	18.67	46.68
13	371324	293118	1.5	Y	40	26.17	65.43
14	371319	293132	1.5	Y	40	26.55	66.38
15	371339	293125	1.5	Y	40	32.20	80.50
16	371346	293115	1.5	Y	40	24.67	61.68
17	371332	293106	1.5	Y	40	21.47	53.68
18	371352	293105	1.5	Y	40	23.76	59.43
19	371338	293095	1.5	Y	40	19.03	47.58
20	371353	293096	1.5	Y	40	29.23	73.10
21	371345	293091	1.5	Y	40	48.09	120.23
22	371356	293090	1.5	Y	40	29.28	73.23
23	371348	293086	1.5	Y	40	47.97	119.93
24	371360	293084	1.5	Y	40	28.12	70.30
25	371352	293080	1.5	Y	40	47.28	118.20

Receptor ID	OS Grid X	OS Grid Y	Height (m)	In AQMA?	AQS objective (µg/m³)	2022 Modelled Annual Mean NO_2 (µg/m³)	% of AQS objective
26	371369	293076	1.5	Y	40	22.83	57.08
27	371369	293076	1.5	Y	40	22.83	57.08
28	371356	293069	1.5	Y	40	20.24	50.60
29	371361	293058	1.5	N	40	18.62	46.58
30	371361	293044	1.5	N	40	16.08	40.23
31	371383	293049	1.5	N	40	15.98	39.95
32	371400	293034	1.5	N	40	10.62	26.55
33	371418	293042	1.5	N	40	10.47	26.20
34	371399	293058	1.5	N	40	12.36	30.90
35	371376	293070	1.5	Y	40	18.89	47.23
36	371388	293075	1.5	Y	40	13.15	32.88
37	371406	293065	1.5	N	40	10.48	26.20
38	371423	293072	1.5	N	40	8.90	22.28
39	371411	293085	1.5	N	40	9.71	24.30
40	371378	293044	4.0	N	40	13.82	34.58
41	371332	293135	1.5	Y	40	39.25	98.13
42	371341	293130	1.5	Y	40	37.01	92.53
43	371342	293141	1.5	Y	40	37.95	94.88
44	371347	293135	1.5	Y	40	35.86	89.65
45	371352	293148	1.5	Y	40	36.38	90.95
46	371357	293140	1.5	Y	40	33.42	83.55
47	371356	293156	1.5	Y	40	24.42	61.05
48	371363	293161	1.5	Y	40	22.91	57.28
48	371372	293167	1.5	Y	40	22.05	55.13
50	371381	293174	1.5	Y	40	21.84	54.60
51	371400	293192	1.5	N	40	15.71	39.30
52	371412	293184	1.5	N	40	13.00	32.50
53	371417	293169	1.5	N	40	12.15	30.38
54	371427	293191	1.5	N	40	10.92	27.30
55	371435	293178	1.5	N	40	10.40	26.00

From the modelled concentrations presented within Table 3-2, it is evident that the AQS annual mean NO_2 objective of 40 µg/m³ is not predicted to be exceeded at any sites outside of the existing AQMA boundary. Additionally, the predicted concentration at receptors outside of the AQMA was not within 10% of the annual mean objective at any location, with the maximum predicted NO_2 annual mean concentration being 18.64 µg/m³ at Receptor 9.

Within the AQMA, the annual mean was exceeded at three receptor sites, with the highest annual mean NO_2 concentration of 48.09 µg/m³ being modelled at receptor 21. This receptor is located in the canyon on Pound Street. The receptors that exceeded the AQO within the Bridgnorth AQMA were all within the canyon on Pound Street. Figure 3-1 illustrates the spatial location of those receptors that exceeded the AQO.

Figure 3-1 - Bridgnorth AQMA Receptors against AQO

3.3 Source Apportionment

Source apportionment has been carried out for the modelled receptors along the road links that are either within the AQMA or lead into the AQMA. Apportionment for both NO_x and NO_2 concentrations has been completed for the vehicle classes listed in Section 2.6. It's worth noting that NO_x concentrations are always higher than those for NO_2 since NO_x is made up of NO and NO_2. There is no air quality limit for human health for NO_x but is nevertheless a useful indicator when considering source apportionment. Results are tabulated in Table 3-4 and Table 3-5 and illustrated in Figure 3-1 to

Figure 3-5

The apportionment between road NO_x and background NO_x has also been detailed in Figure 3-3 and Table 3.3. Local Background NO_x, which is considered to be the emissions a local authority has influence over, including building, road and rail emissions etc, accounts for just approximately 11% of the total NO_x concentration on average at all receptor locations. Regional background NO_x concentrations account for those emissions that the local authority has no influence over, these emissions account for just over 9% of total NO_x concentrations on average at all modelled receptors. With a total 80% of NO_x emissions on average within the Bridgnorth AQMA deriving from local road traffic.

The source apportionment results provide the relative contribution (as a percentage) of each vehicle type towards a specific pollutant. Therefore, when considering the average NO_x concentration across all modelled receptors, road traffic is responsible for 79.8% of emissions (30.2 µg/m³). Of the total road NO_x, diesel cars are the biggest contributor accounting for 52.9% of emissions, followed by diesel large-good vehicles (26.8%) and petrol cars (7.5%).

When considering the modelled receptor location at which the maximum road NO_x concentration is observed, road traffic is responsible for 91.9% of total NO_x emissions. Of the road traffic proportion, 53.6% is from diesel cars, 27.2% from diesel LGV's and 7.9% from petrol cars. These numbers only slightly differentiate from the average across all modelled receptors, likely due to the small size of the AQMA, with the influence of emissions on the maximum receptor similar to those experienced across the AQMA.

3.4 Modelled NO_2 Concentration – Contour Plot

The contour plot in Figure 3-2 indicates that there are exceedances of the NO_2 annual mean from the main junction within the Bridgnorth AQMA to Pound Street, Whitburn Street and Salop Street where there are observed street canyons. Concentrations greater than 50 µg/m³ are predicted along Whitburn Street and Pound Street where there are observed street canyons, however these are not observed at any receptor locations, i.e., at sites of relevant exposure.

From the plot, it is evident that the predicted exceedances of the annual mean objective are strictly constrained to the road network, therefore come in close range to any residential properties that are located close to the road. The street canyons observed on Whitburn Street and Pound Street also have residential properties on either side, and it is here where the main exceedances of the AQO are observed, as shown in Figure 3-1.

There are multiple receptors of relevant exposure that come into contact with the 40 µg/m³ limit contour within the AQMA. Therefore, as a result of these predicted exceedances, the current AQMA designation should remain.

In combination with Figure 3-1, there are no receptors outside of the AQMA designation that exceed the AQO.

Figure 3-2 - Contour Plot of Modelled NO_2 Concentrations

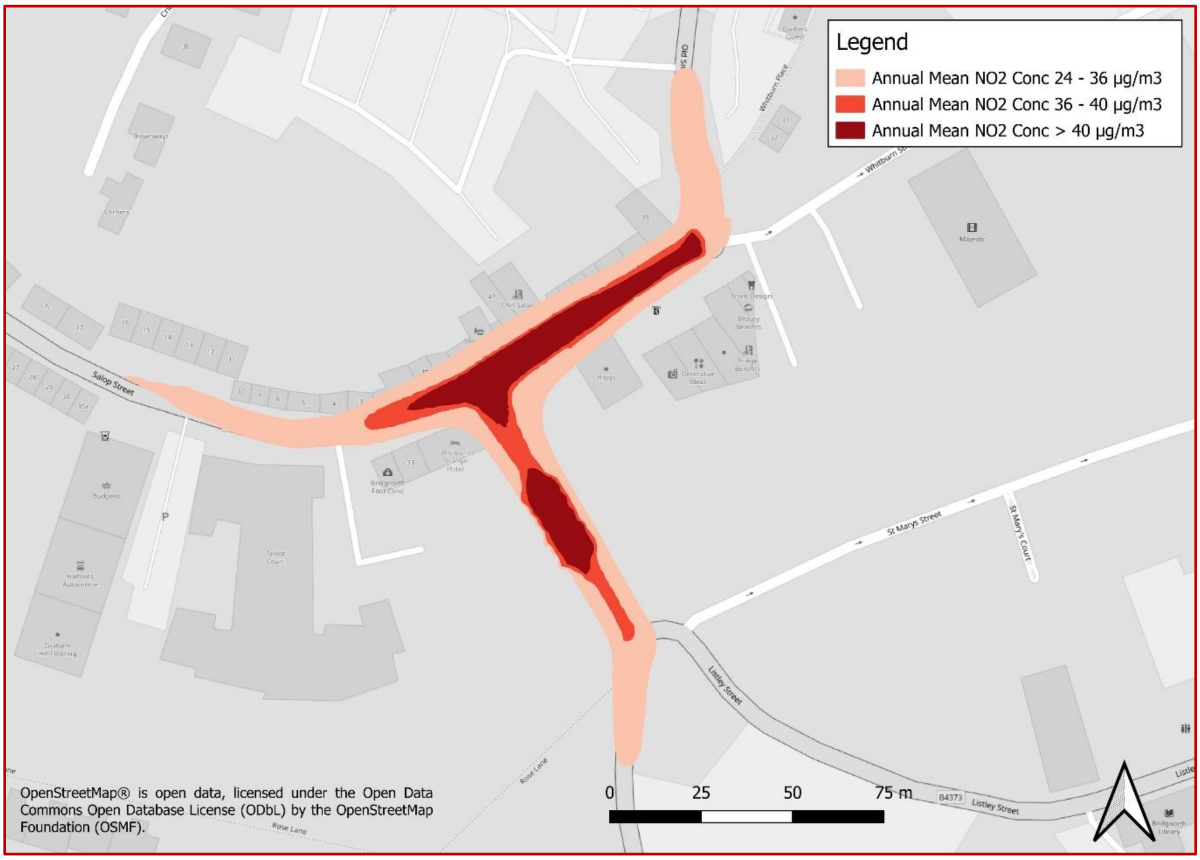


Table 3-3 - Total NO_x Source Apportionment Across All Receptors

Results	Local Background NO_x	Regional Background NO_x	Local Road NO_x
NO_x Concentration (µg/m^3)	4.3	3.4	30.2
Percentage of total NO_x	11.3%	8.9%	79.8%

Table 3-4 - NO_x Source Apportionment Results

Results	All Vehicles	Petrol Cars	Diesel Cars	Petrol LGV	Diesel LGV	Rigid HGV	Arctic HGV	Buses	Motorcycle	Full Hybrid Petrol Cars	Plug-in Hybrid Petrol Cars	Full Hybrid Diesel Cars	EV Cars	Background
Average Across All Modelled Receptors														
NO_x Concentration (µg/m^3)	30.2	2.3	16.0	0.0	8.1	1.3	0.5	1.8	0.0	0.0	0.0	0.1	0.0	7.6
Percentage of Total NO_x	79.8%	6.0%	42.2%	0.1%	21.4%	3.5%	1.4%	4.7%	0.1%	0.1%	0.0%	0.2%	0.0%	20.2%
Percentage Contribution to Road NO_x	100.0%	7.5%	52.9%	0.1%	26.8%	4.4%	1.8%	5.9%	0.1%	0.1%	0.0%	0.3%	0.0%	-
Max Modelled Receptor (25)														
NO_x Concentration (µg/m^3)	87.0	6.9	46.6	0.1	23.6	3.4	1.4	4.5	0.1	0.1	0.0	0.3	0.0	7.6
Percentage of Total NO_x	91.9%	7.3%	49.2%	0.1%	25.0%	3.5%	1.5%	4.8%	0.1%	0.1%	0.0%	0.3%	0.0%	8.1%
Percentage Contribution to Road NO_x	100.0%	7.9%	53.6%	0.1%	27.2%	3.9%	1.6%	5.2%	0.1%	0.2%	0.0%	0.3%	0.0%	-

Table 3-5 - NO_2 Source Apportionment Results

Results	All Vehicles	Petrol Cars	Diesel Cars	Petrol LGV	Diesel LGV	Rigid HGV	Arctic HGV	Buses	Motorcycle	Full Hybrid Petrol Cars	Plug-in Hybrid Petrol Cars	Full Hybrid Diesel Cars	EV Cars	Background
Average Across All Modelled Receptors														
NO_2 Concentration (µg/m^3)	15.6	1.2	8.2	0.0	4.2	0.7	0.3	0.9	0.0	0.0	0.0	0.0	0.0	6.0
Percentage of Total NO_2	72.0%	5.4%	38.2%	0.1%	19.3%	3.2%	1.3%	4.2%	0.1%	0.1%	0.0%	0.2%	0.0%	28.0%
Percentage Contribution to Road NO_2	100.0%	7.5%	53.0%	0.1%	26.8%	4.4%	1.8%	5.9%	0.1%	0.2%	0.0%	0.3%	0.0%	-
Max Modelled Receptor (25)														
NO_2 Concentration (µg/m^3)	42.1	3.3	22.1	0.0	11.2	1.6	0.7	2.1	0.1	0.1	0.0	0.1	0.0	6.0
Percentage of Total NO_2	87.4%	6.8%	45.9%	0.1%	23.3%	3.3%	1.4%	4.5%	0.1%	0.1%	0.0%	0.3%	0.0%	12.6%
Percentage Contribution to Road NO_2	100.0%	7.8%	52.5%	0.1%	26.6%	3.8%	1.6%	5.1%	0.1%	0.2%	0.0%	0.3%	0.0%	-

Figure 3-3 - Average NO_x Background Split

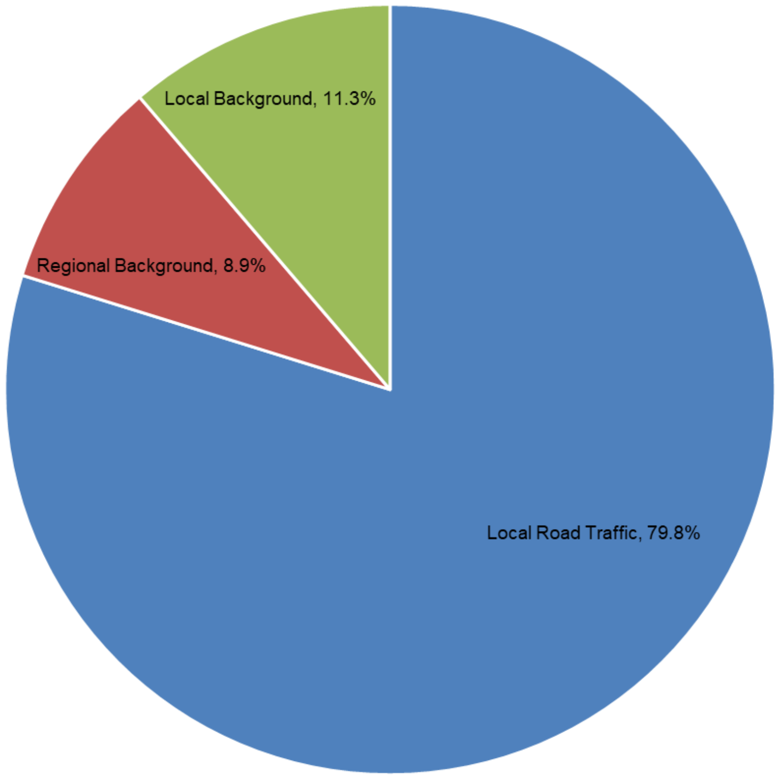


Figure 3-4 - NO_x Source Apportionment Average Across All Modelled Receptors

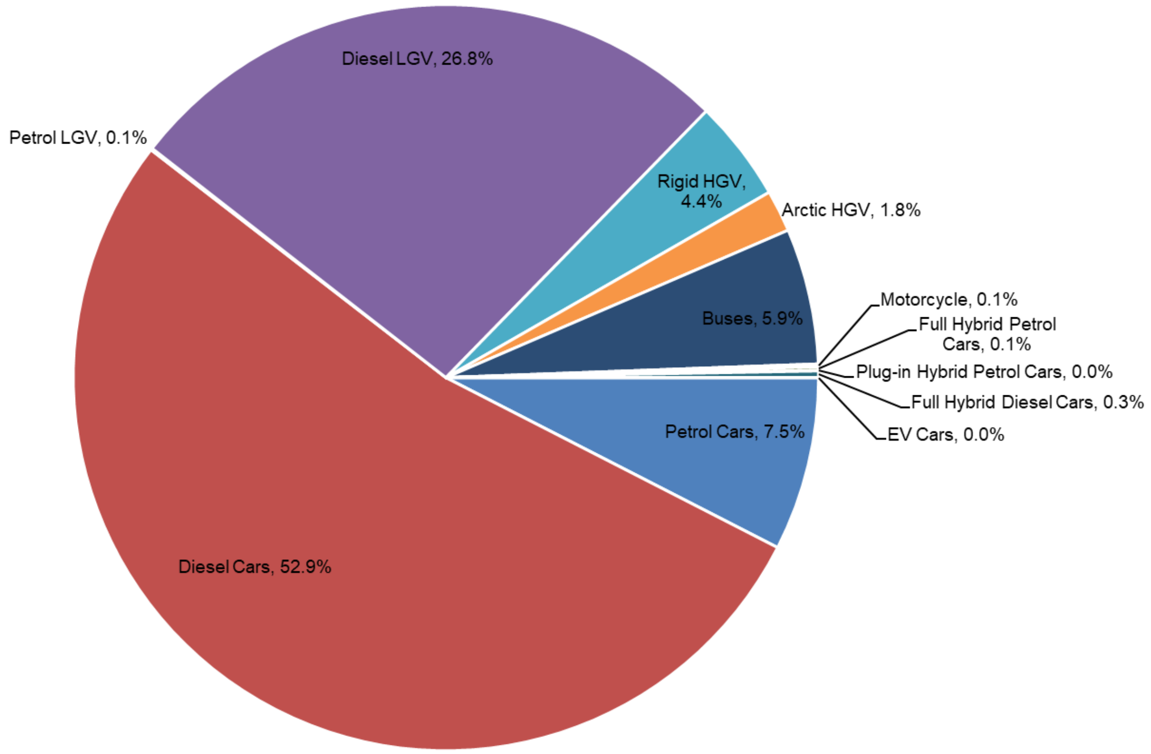
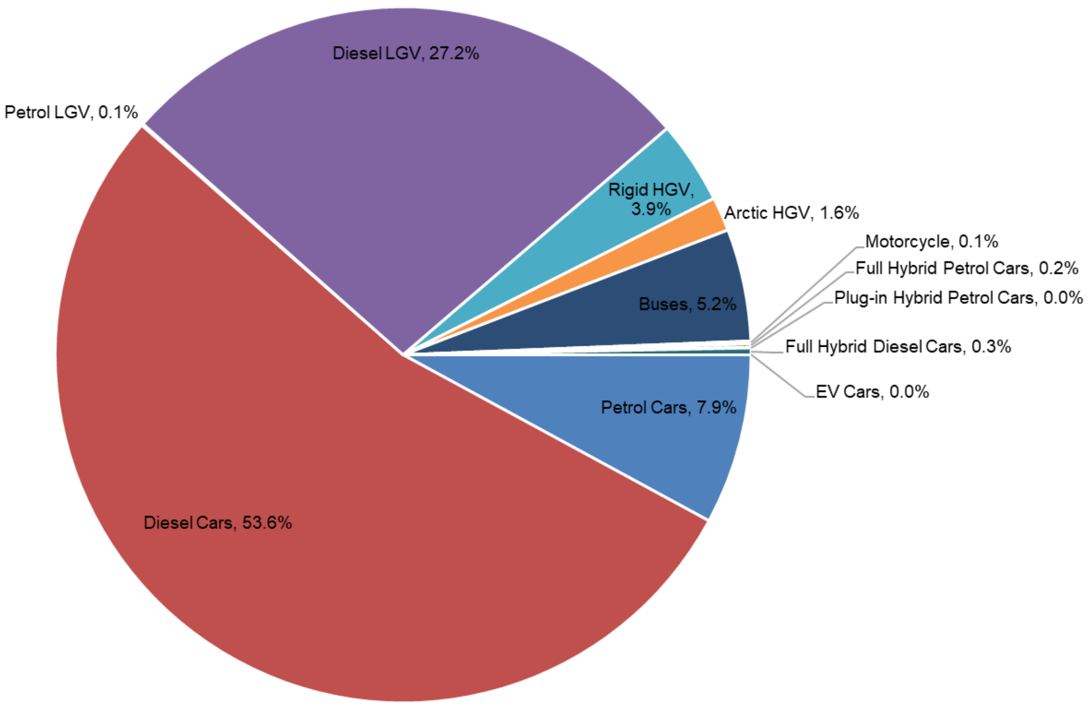


Figure 3-5 - NO_x Source Apportionment at Max Modelled Receptor (25)



4 Conclusions and Recommendations

Following the completion of the analysis of both monitoring data and modelled concentrations across the modelled area, in particular the current Bridgnorth AQMA, the following conclusions and recommendations are made.

4.1 Bridgnorth AQMA

The Bridgnorth AQMA is currently designated for exceedances of the NO_2 annual mean, with two out of the 17 diffusion tube monitoring locations exceeding the AQO of 40µg/m^3 within the AQMA in 2022, and a further one site within 10% of the AQO. One of the sites exceeding the AQO in 2022 is DF83, a new diffusion tube monitoring site located on Pound Street, this site is also the highest monitored diffusion tube within the Bridgnorth AQMA.

Detailed modelling has predicted areas of exceedance in line with the Bridgnorth AQMA boundary with the highest modelled exceedance 48.1 µg/m^3 at receptor 21, which is located in the canyon and incline on Pound Street, adjacent to a zebra crossing where there is likely to be idling of vehicles.

Based upon the analysis of results, it is recommended that the AQMA remains in place with the current boundary and monitoring should continue in this area. It should be noted that like with the monitored results, no receptors outside of the AQMA boundary exceeded the AQO in the modelled results.

4.2 Source Apportionment

An initial review of the road NO_x and background NO_x apportionment indicated that road NO_x accounted for 80% of emissions on average across all modelled receptors and background concentrations 20% of emissions. This details that road contribution is the primary cause of the exceedances of the AQO within the Bridgnorth AQMA.

Source apportionment analysis of the Bridgnorth AQMA demonstrates that diesel cars account for the largest amounts of road NO_x (around 53%) with diesel LGVs and petrol cars the next largest contributors (27% and 8% respectively). As such, measures contained within the AQAP should focus on reducing emissions from these vehicle classes.

Appendix A – Traffic Data

Table A.1 – Annual Average Daily Traffic (AADT) Data

Source ID	Source Name	Speed (kph)	Traffic Flow (AADT)	HGV %	Bus %	LGV%	Cars%	Motorbike%
1a	Salop Street	32	8729	1.23	0.57	9.15	88.87	0.19
1b	Salop Street	20	8729	1.23	0.57	9.15	88.87	0.19
1bsd2	Salop Street	5	8729	1.23	0.57	9.15	88.87	0.19
2asd1	Whitburn Street	5	11159	1.06	0.96	7.38	90.36	0.24
2asd2	Whitburn Street	10	11159	1.06	0.96	7.38	90.36	0.24
3asd1	Old Smithfield	20	9766	1.08	1.09	6.98	90.64	0.22
4asd1	B4364	20	1610	1.32	0.02	10.20	88.04	0.41
5asd1	Pound Street	10	9980	0.98	0.86	9.37	88.52	0.26
5asd2	Pound Street	10	9980	0.98	0.86	9.37	88.52	0.26
5asd3	Pound Street	10	9980	0.98	0.86	9.37	88.52	0.26
6asd1	Hollybush Road	20	9780	1.00	0.88	9.09	88.74	0.29
7asd1	Listley Street	20	2594	0.78	0.01	10.69	88.10	0.41
8asd1	St Mary Street	20	281	1.07	0.00	16.13	82.21	0.59

Appendix B – Model Verification

Model Setup

The ADMS-Roads dispersion model has been widely validated for this type of assessment and is specifically listed in the LAQM.TG(22) guidance as an accepted dispersion model.

Model validation undertaken by the software developer (CERC) will not have included validation in the specific modelled area. It is therefore necessary to perform a comparison of modelled results with local monitoring data at relevant locations. This process of verification attempts to minimise the modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results.

The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including uncertainties associated with:

- Background concentration estimates;
- Source activity data such as traffic flows and emissions factors;
- Monitoring data, including locations; and
- Overall model limitations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all these aspects.

Model setup parameters and input data were checked prior to running the models in order to reduce these uncertainties. The following were checked to the extent possible to ensure accuracy:

- Traffic data;
- Distance between sources and monitoring as represented in the model;
- Speed estimated on roads; and
- Background monitoring and background estimates.

NO_2 Verification Calculations

The verification of the model output was performed in accordance with the guidance provided in Chapter 7 of LAQM.TG(22).

Relevant monitoring locations within the Council's jurisdiction (those adjacent to modelled roads) have been used in the verification. This included all diffusion tube sites within the Bridgnorth AQMA, detailed in Table 3-1, In total, only the roadside passive (diffusion tube) monitoring site DF13 was excluded for model verification. DF13 monitored an NO2 concentrations that was 10 µg/m3 lower than monitoring site DF71, which is located around 5m north and exceeds the AQO. It was considered that although there are canyon effects observed on Pound Street where both sites are located, that due to a small 0.5m gap in the buildings where DF13 is located that there could be potential microclimate dynamics that were resulting in lower observed concentrations and could not be replicated in model. As such, a conservative approach was taken and DF13 was excluded from the model verification.

It should be noted that due to the incline observed on Pound street a 10% gradient was applied to the road through the EFT v12.0.1 function when calculating vehicle emissions.

Table B.1 below shows an initial comparison of the monitored and unverified modelled NO_2 results for the year 2022, in order to determine if verification and adjustment was required.

Table B.1 – Unverified Modelled and Monitored NO_2 Concentrations

Site ID	Background NO_2 (µg/m^3)	Monitored Total NO_2 (µg/m^3)	Unverified Modelled Total NO_2 (µg/m^3)	% Difference (Modelled vs. Monitored)
DF81	6.0	21.3	10.4	-51.3
DF80	6.0	37.6	12.9	-65.7
DF79	6.0	35.6	12.6	-64.6
DF78	6.0	32.9	12.2	-62.9
DF77	6.0	29.2	11.8	-59.4
DF76	6.0	29.5	12.0	-59.5
DF75	6.0	23.9	11.2	-53.2
DF74	6.0	24.4	11.3	-53.6
DF72	6.0	22.6	9.8	-56.9
DF71	6.0	41.5	16.6	-59.9
DF29	6.0	23.3	9.8	-58.1
DF28	6.0	35.8	12.3	-65.8
DF83	6.0	47.8	17.0	-64.4
DF73	6.0	27.3	10.6	-61.1

The data in Table B.1 shows that the model was under predicting at all monitoring locations. At this stage, all model inputs were checked to ensure their accuracy; this includes road and monitoring site geometry, traffic data, link emission rates, 2022 monitoring results, background concentrations and modelling features such as street canyons. Following a level of QA/QC completed upon the model, no further improvement of the modelled results could be obtained on this occasion. The difference between modelled and monitored concentrations was greater than -25% at the majority of locations therefore adjustment of the results was necessary. The relevant data was then gathered to allow the adjustment factor to be calculated.

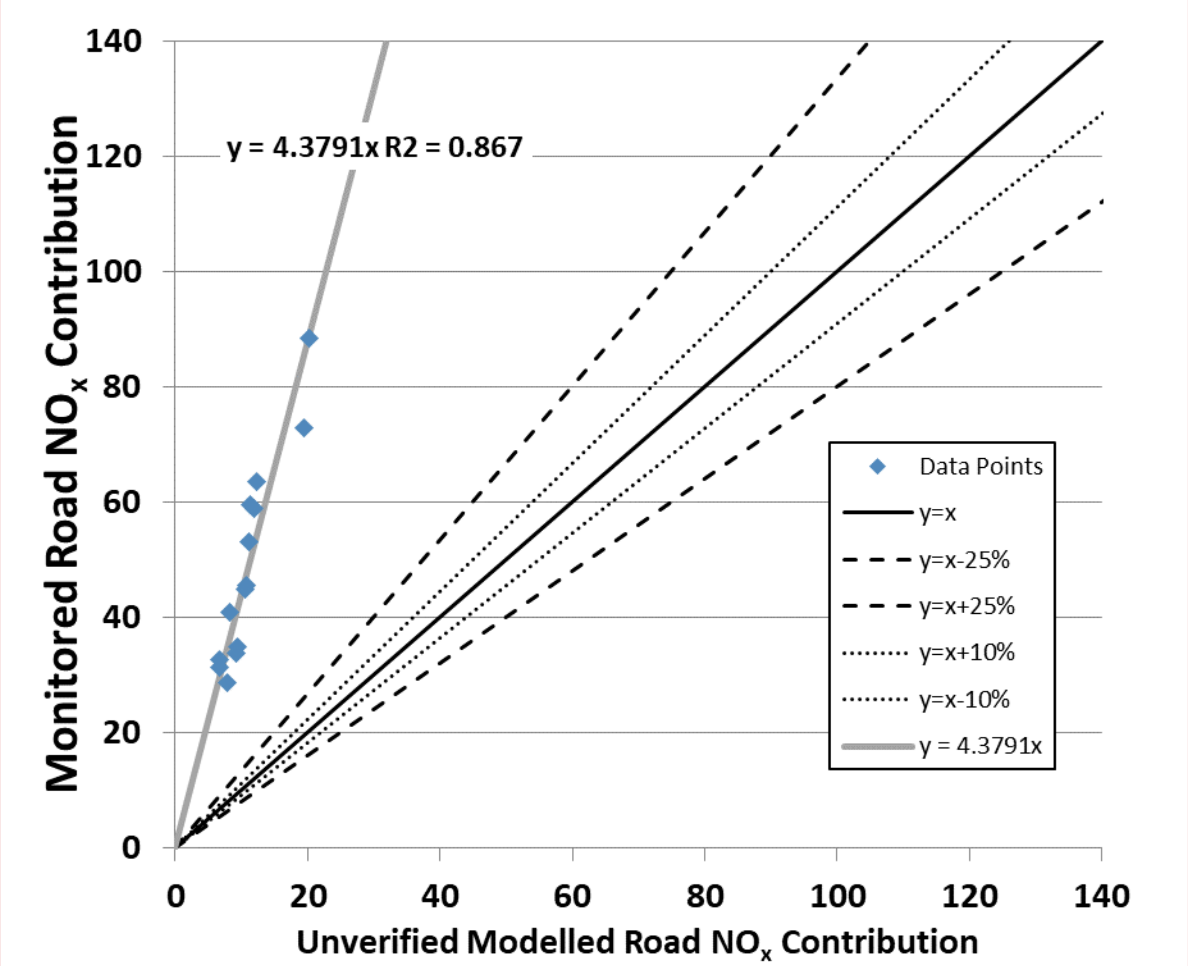
Table B.2 provides the relevant data required to calculate the model adjustment based on regression of the modelled and monitored road source contribution to NO_x.

Table B.2 – Data Required for Adjustment Factor Calculation

Site ID	Monitored Total NO_2 (µg/m^3)	Monitored Total NO_x (µg/m^3)	Background NO_2 (µg/m^3)	Background NO_x (µg/m^3)	Monitored Road Contribution NO_2 (Total - Background) (µg/m^3)	Monitored Road Contribution NO_x (Total - Background) (µg/m^3)	Modelled Road Contribution NO_x (Excludes Background) (µg/m^3)
DF81	21.3	36.3	6.0	7.6	15.3	28.6	7.8
DF80	37.6	71.1	6.0	7.6	31.5	63.5	12.4
DF79	35.6	66.6	6.0	7.6	29.5	59.0	11.9
DF78	32.9	60.7	6.0	7.6	26.9	53.1	11.2
DF77	29.2	52.5	6.0	7.6	23.1	44.8	10.5
DF76	29.5	53.2	6.0	7.6	23.5	45.6	10.7
DF75	23.9	41.4	6.0	7.6	17.8	33.8	9.2
DF74	24.4	42.5	6.0	7.6	18.4	34.9	9.5
DF72	22.6	38.9	6.0	7.6	16.6	31.3	6.6
DF71	41.5	80.5	6.0	7.6	35.5	72.8	19.5
DF29	23.3	40.3	6.0	7.6	17.3	32.7	6.7
DF28	35.8	67.2	6.0	7.6	29.8	59.6	11.2
DF83	47.8	96.0	6.0	7.6	41.8	88.4	20.2
DF73	27.3	48.5	6.0	7.6	21.3	40.9	8.2

Figure B.1 provides a comparison of the modelled road contribution NO_x versus monitored road contribution NO_x, and the equation of the trend line based on linear regression through zero. The total monitored NO_x contribution has been derived by back-calculating NO_x from the NO_x/NO_2 empirical relationship using the spreadsheet tool available from Defra's website. The equation of the trend lines presented in Figure B.1 gives an adjustment factor for the modelled results of 4.379.

Figure B.1 – Unverified Modelled Road NO_x Contribution



Model adjustment needs to be undertaken for NO_x rather than NO_2. For the monitoring results used in the calculation of the model adjustment, NO_x was derived from NO_2, using the NO_x to NO_2 calculator (V8.1) spreadsheet tool available from the LAQM website.

The results of the final verification factor are presented in Table B.3. All diffusion tube locations are within the ±25% acceptance level. Alongside this, the RMSE for this verification is 2.9, which according to TG(22) as the RMSE is below 4, indicates that this final verification is performing accurately. The verification factor used for the receptors in this AQA is 4.379.

Table B.3 – Final Verification Calculation

Site ID	Ratio of Monitored Road Contribution NO_x / Modelled Road Contribution NO_x	Adjustment Factor for Modelled Road Contribution NO_x	Adjusted Modelled Road Contribution NO_x (µg/m³)	Adjusted Modelled Total NO_x (Including Background NO_x) (µg/m³)	Modelled Total NO_2 (Based upon Empirical NO_x / NO_2 Relationship) (µg/m³)	Monitored Total NO_2 (µg/m³)	% Difference (Adjusted Modelled NO_2 vs. Monitored NO_2)
DF81	3.67	4.379	34.1	41.8	24.1	21.3	12.8
DF80	5.13		54.2	61.8	33.4	37.6	-10.9
DF79	4.96		52.1	59.7	32.5	35.6	-8.7

DF78	4.75		49.0	56.6	31.1	32.9	-5.7
DF77	4.28		45.9	53.5	29.6	29.2	1.6
DF76	4.27		46.8	54.4	30.1	29.5	1.9
DF75	3.65		40.5	48.1	27.1	23.9	13.6
DF74	3.68		41.5	49.2	27.6	24.4	13.2
DF72	4.71		29.1	36.7	21.5	22.6	-4.9
DF71	3.74		85.3	93.0	46.6	41.5	12.3
DF29	4.89		29.3	36.9	21.6	23.3	-7.2
DF28	5.30		49.2	56.9	31.2	35.8	-13.0
DF83	4.37		88.5	96.1	47.9	47.8	0.1
DF73	4.98		36.0	43.6	24.9	27.3	-8.6

Figure B.2 – Verified Modelled Road NO_x Contribution

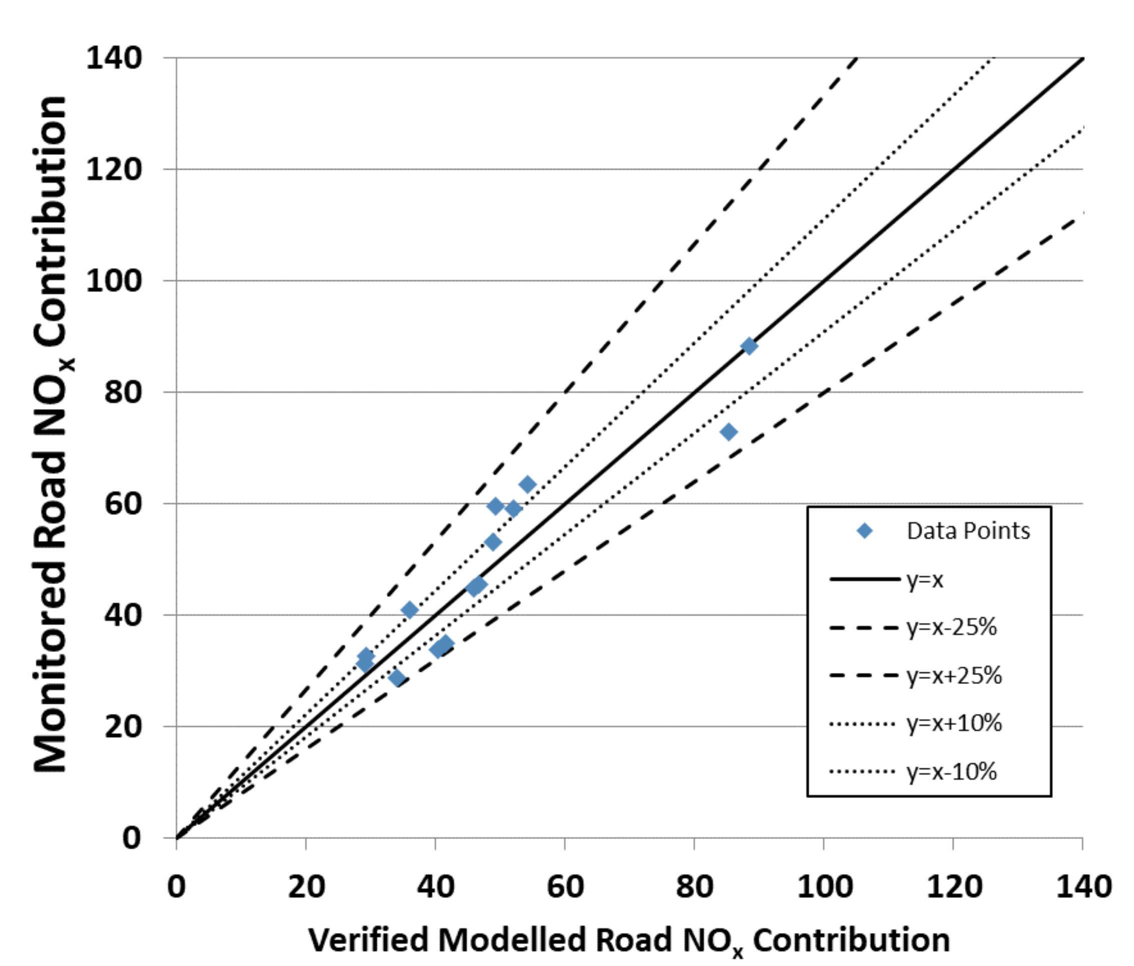
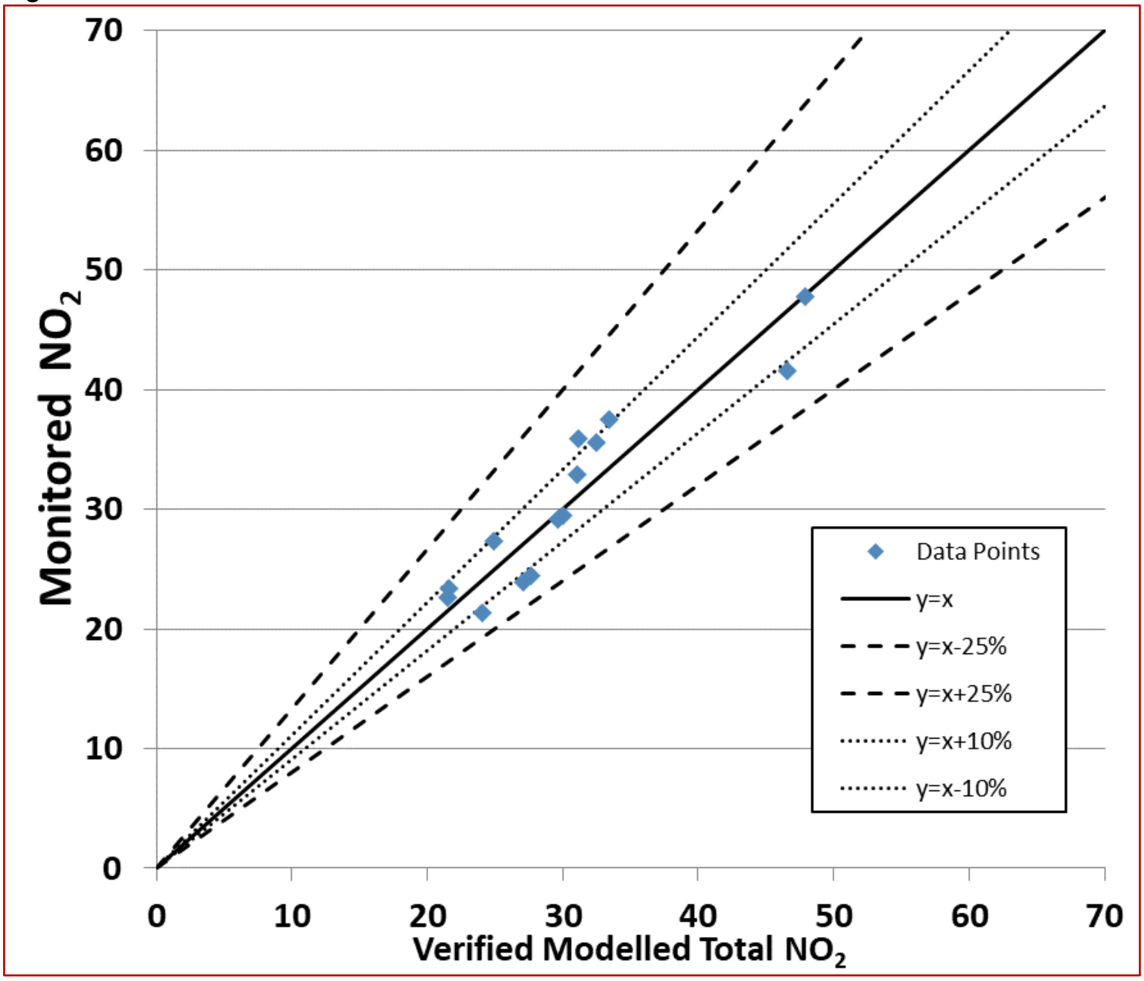


Figure B.3 – Verified Modelled Total NO_2



Glossary of Terms

Abbreviation	Description
AADT	Annual Average Daily Traffic
ANPR	Automatic Number Plate Recognition
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values’
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
AQO	Air Quality Objective
AQS	Air Quality Strategy
ASR	Air Quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
EU	European Union
EFT	Emissions Factor Toolkit
EV	Electric Vehicle
HGV	Heavy Goods Vehicle
IMD	Indices of Multiple Deprivation
LAQM	Local Air Quality Management

LCWIP	Local Cycling and Walking Infrastructure Plan
LGV	Light Goods Vehicles
LSOA	Lower Super Output Area
LTP	Local Transport Plan
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NH_3	Ammonia
PG	Policy Guidance
PCN	Penalty Charge Notice
PHOF	Public Health Outcomes Framework
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
PSV	Passenger Service Vehicle
TG	Technical Guidance

References

[1] Defra, Emissions Factors Toolkit – version 11.0 (2021), available at: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/
[2] Shropshire Council Highways Team Traffic Counts 2023, via internal communications
[3] Department for Transport (DfT) Road Traffic Counts (2023) available at: https://roadtraffic.dft.gov.uk
[4] Bureau Veritas, 2023, Shropshire AQAP Bridgnorth AQMA Technical Report
[5] Defra, 2022, Local Air Quality Management Technical Guidance